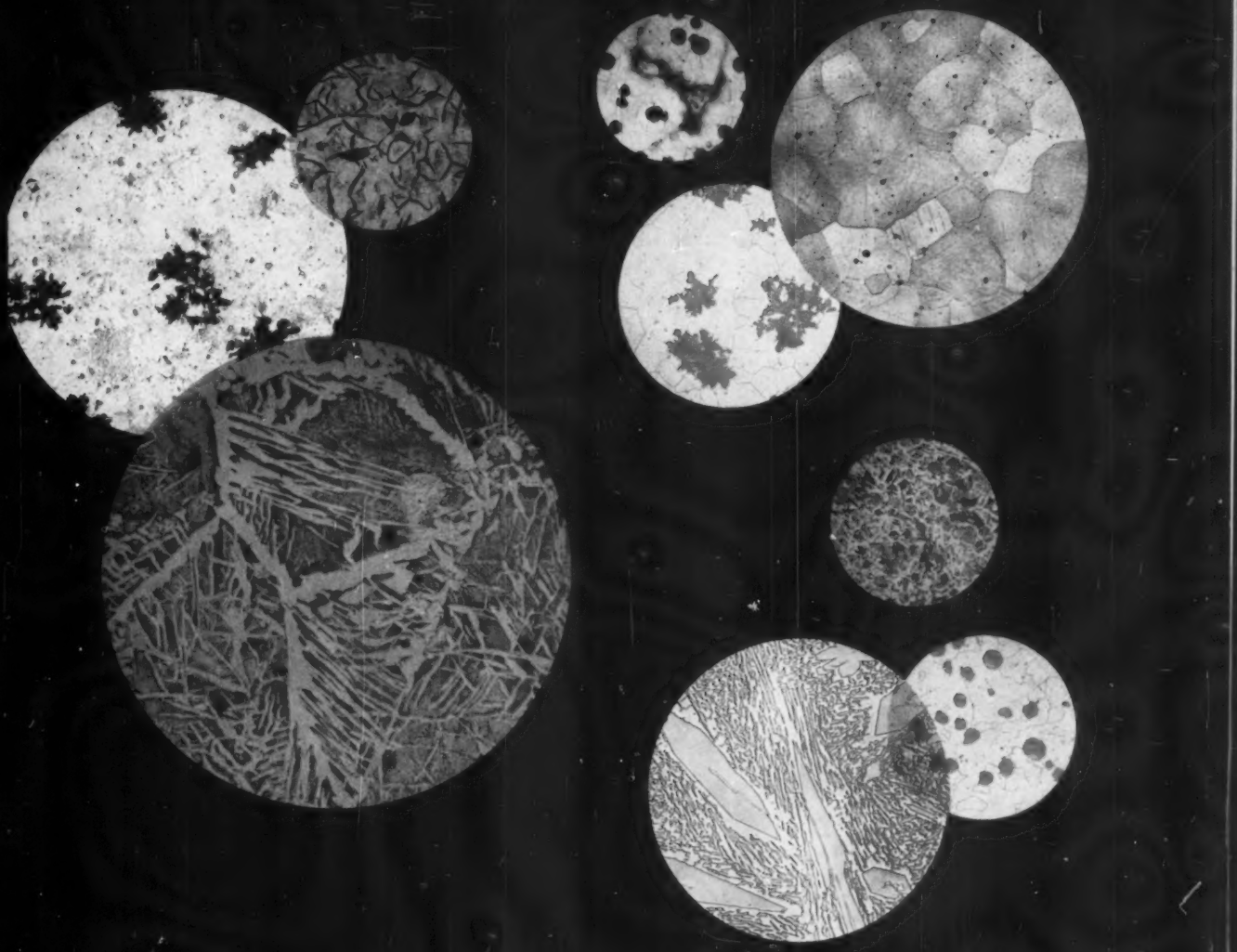
RETURN POSTAGE GUARANTEED

DECEMBER, 1959

Golf & Wolf Rds., Des Plaines, Ill.

modern castings



■ These Photomicrographs Identify Proposed Classification of Cast Ferrous Materials.

ALSO IN THIS ISSUE . . . ■ YOUR FOUNDRY *cannot survive unless* . . . ■ COUNTDOWN *on shell core and pattern equipment* . . . ■ DEXTROSE *scores knockout in* CO_2 *process* . . ■ FOUNDRYMEN vs AERO-ENGINEERS.

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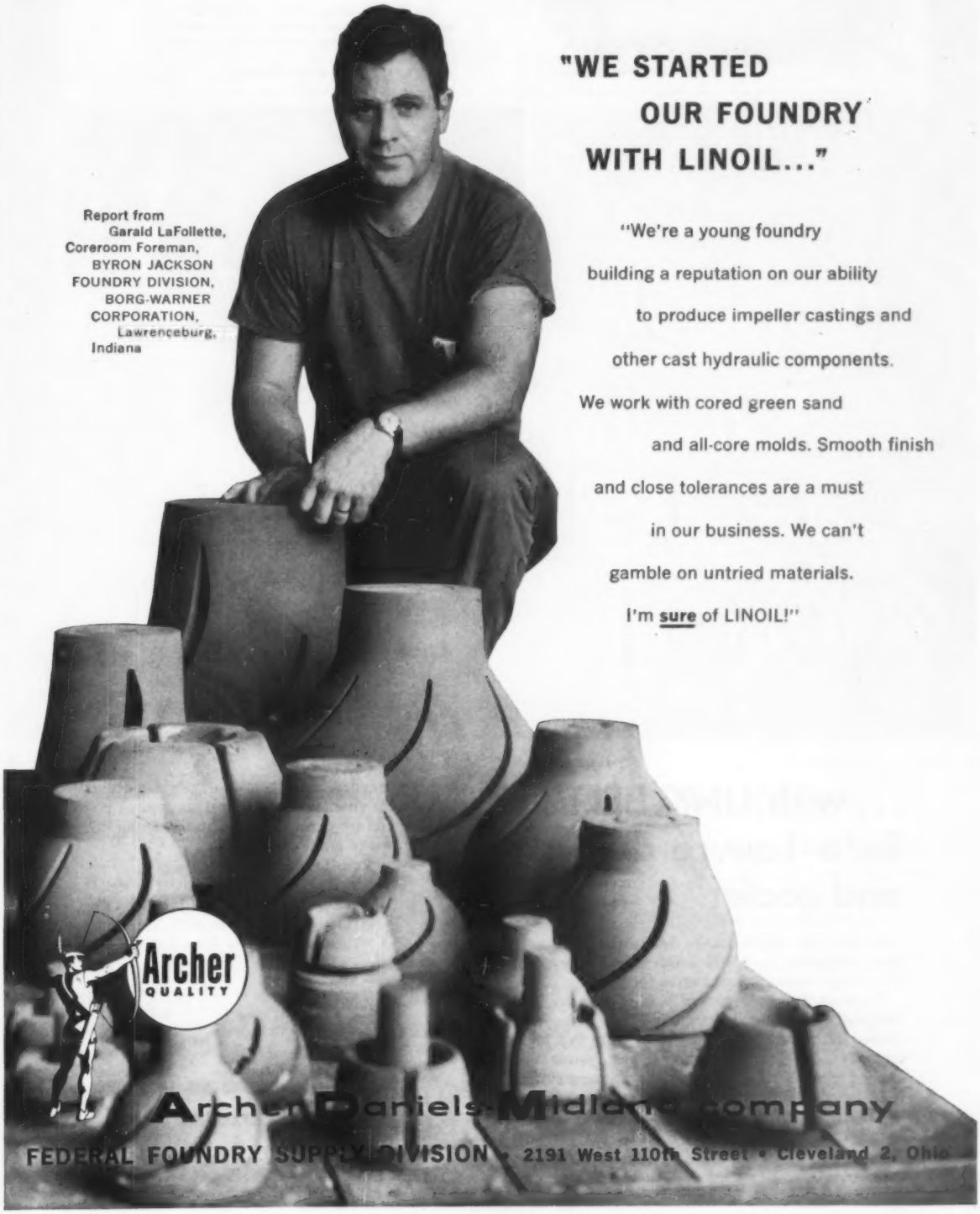
*Patent Pending

FOR MORE INFORMATION on how to obtain top quality in your castings, write The Carborundum Co., Dept. M-95, Niagara Falls, N.Y.

Circle No. 145, Page 21 or 79

GAMBLERS ?....NO!



Report from
Garald LaFollette,
Coreroom Foreman,
BYRON JACKSON
FOUNDRY DIVISION,
BORG-WARNER
CORPORATION,
Lawrenceburg,
Indiana

"WE STARTED OUR FOUNDRY WITH LINOIL..."

"We're a young foundry building a reputation on our ability to produce impeller castings and other cast hydraulic components. We work with cored green sand and all-core molds. Smooth finish and close tolerances are a must in our business. We can't gamble on untried materials. I'm **sure** of LINOIL!"

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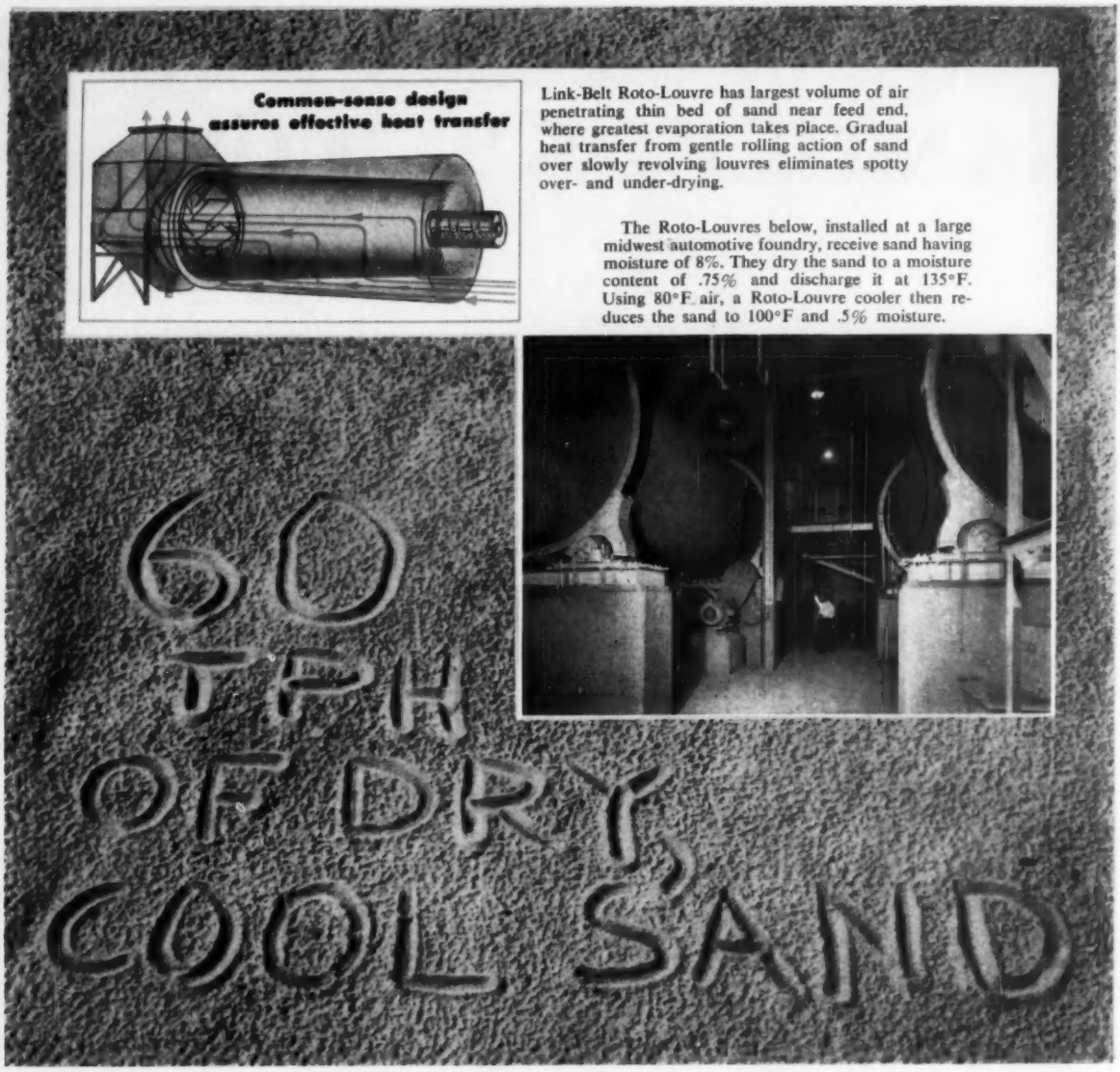
Archer Daniels Midland Company

FEDERAL FOUNDRY SUPPLY DIVISION • 2191 West 110th Street • Cleveland 2, Ohio


Common-sense design assures effective heat transfer
Link-Belt Roto-Louvre has largest volume of air penetrating thin bed of sand near feed end, where greatest evaporation takes place. Gradual heat transfer from gentle rolling action of sand over slowly revolving louvres eliminates spotty over- and under-drying.
The Roto-Louvres below, installed at a large midwest automotive foundry, receive sand having moisture of 8%. They dry the sand to a moisture content of .75% and discharge it at 135°F. Using 80°F air, a Roto-Louvre cooler then reduces the sand to 100°F and .5% moisture.
60 T.P.H. OF DRY, COOL SAND

. . . with LINK-BELT Roto-Louvre dryers and cooler

Two Link-Belt Roto-Louvre dryers and one cooler have eliminated a costly sand shortage problem for a large midwest automotive foundry.

Because their old system was inadequate and antiquated, additional dried sand had to be purchased at premium costs. Now, with the high-capacity Link-Belt dryers and cooler, production needs are easily met. What's more, the new system is designed to handle anticipated future needs.

This is just one of many foundries that have found Link-Belt Roto-Louvre to be the low-cost answer to needed capacity. Roto-Louvre efficiency results from an exclusive design that assures positive temperature control . . . and uniform air contact with *every* grain of sand.

Roto-Louvres can be used as dryers, dryers-coolers or coolers. For details, contact your nearest Link-Belt office. Or write for Foundry Equipment Book 2423 and Roto-Louvre Book 2511.

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HANDLING AND SAND PREPARATION MACHINERY

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses and District Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 15,286

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modern castings

the technical magazine of the metalcasting industry

december, 1959
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features

YOUR FOUNDRY CANNOT SURVIVE UNLESS . . .
you develop Administrative Management / by Bruce L. Simpson **36**
The number one task of any company president should be a constant and continuous effort to find a substitute for himself.

YOUR FOUNDRY CANNOT SURVIVE UNLESS . . .
you develop Technical Personnel / by John H. Culling **36**
Innovation is the most important function in the technical phase of management. Technical development must be a never ending process in foundries.

YOUR FOUNDRY CANNOT SURVIVE UNLESS . . .
you develop Operating Supervisors / by L. J. Woehlke **37**
The growing importance of foundry technology in foundry operations makes it imperative to select operating supervisors with engineering backgrounds.

COUNTDOWN ON CONSTRUCTION HINTS
for shell core box and pattern equipment / by Earl W. Jahn **40**
If you design, build, purchase or use patterns for shell molds or core boxes for shell cores, then read this article.

DEXTROSE SCORES KNOCKOUT IN CO_2 PROCESS
by Daniel R. Pohlman **42**
Are your CO_2 process cores hard to knockout? Do you need better core collapsibility? Then maybe dextrose can help solve your problems.

FOUNDRYMEN vs AERO-SPACE ENGINEERS
by John H. Rassenfoss and Y. J. Elizondo **45**
Can the metalcasting industry meet the rigid needs of today's vast aerospace complex? Apparently not . . . in the opinion of many aircraft engineers. Here are both sides of the story. You be the judge.

INTERNATIONAL CLASSIFICATION OF FERROUS CAST METALS
by Adalbert Wittmoser **47**
This famous German metallurgist has long realized the need for an international classification of ferrous cast metals. Now he is publishing his recommendations for bringing order out of metallurgy chaos.

featurettes

RISERLESS CASTINGS / by C. W. Gilchrist **13**
HEALING HOT TEARS WITH VIBRATION **30**

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For over 70 years, Pittsburgh Crushed Steel Company has consistently led the metal abrasives industry—has led in research and product development—has led in the improvement of production methods—and has led in sales and service facilities as well as in distribution facilities!

The results have been better metal abrasives for lower cleaning costs in foundries, forge plants, and steel and metal working plants in general!

Today, through 13 distributing points and 33 sales-service offices, we supply all sizes and types of metal abrasives, iron and steel, for every type of blast-cleaning equipment and for every blast-cleaning requirement!

Our engineering, sales, and service representatives are always available to you in connection with your blast-cleaning needs.

PITTSBURGH CRUSHED STEEL COMPANY

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Subsidiaries: Globe Steel Abrasive Co., Mansfield, Ohio
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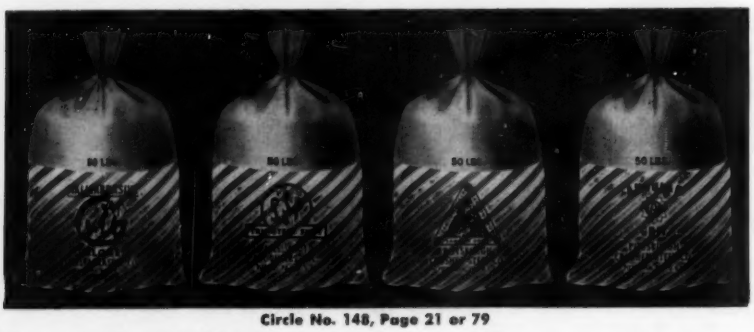
MALLEABRASIVE | **TRU-STEEL SHOT** | **SAMSON SHOT** | **ANGULAR GRIT**



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future meetings and exhibits

Dec. 2 . . Foundry Facings Manufacturers Association, *Annual Meeting*. Hotel Waldorf-Astoria, New York.

Dec. 2-4 . . Metallurgical Society, American Institute of Mining, Metallurgical & Petroleum Engineers, *Electric Furnace Conference*. Sheraton-Cleveland Hotel, Cleveland.

Dec. 2-4 . . National Association of Manufacturers, *Annual Meeting*. Waldorf-Astoria Hotel, New York.

Dec. 4 . . Malleable Founders Society, *Western Section Meeting*. Drake Hotel, Chicago.

Dec. 15 . . Material Handling Institute, *Annual Meeting*. Savoy-Hilton Hotel, New York.

1960

Jan. 11-15 . . Society of Automotive Engineers, *Annual Meeting*. Statler and Sheraton-Cadillac Hotels, Detroit.

Jan. 15 . . Malleable Founders Society, *Semi-Annual Meeting*. Hotel Sheraton-Cleveland, Cleveland.

Jan. 25-28 . . *Plant Maintenance & Engineering Show*. Convention Hall, Philadelphia.

Feb. 1-5 . . American Society for Testing Materials, *Committee Week*. Hotel Sherman, Chicago.

Feb. 11-12 . . AFS *Wisconsin Regional Foundry Conference*. Hotel Schroeder, Milwaukee.

Feb. 14-18 . . American Institute of Mining, Metallurgical & Petroleum Engineers, *Annual Meeting*. New York.

Feb. 18-19 . . AFS *Southeastern Regional Foundry Conference*. Hotel Thomas Jefferson, Birmingham, Ala.

Feb. 22-24 . . Material Handling Institute, *Pacific Coast Show*. Cow Palace, San Francisco.

Continued on page 8

MODERN CASTINGS is indexed by Engineering Index, Inc., 29 West 39th St., New York 18, N. Y. and microfilmed by University Microfilms, 313 N. First St., Ann Arbor, Mich.
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NEW!

A NEW NAME

FOR DELTA PERMI-BOND . . . AN IMPROVED FORMULA

SEA COAL AND PITCH REPLACEMENT

DELTA SAND·ADD

SEA COAL AND PITCH REPLACEMENT

300-4X Contains C, H, O, N.

Eliminate the DIRT, SMOKE, SOOT of PITCH and SEA COAL END ASH CONTAMINATION of YOUR SAND

Get Cleaner Castings . . . at Lower Cost

A new achievement by DELTA Research Scientists to provide these added advantages in your foundry:

- SAND·ADD is consistently uniform — chemically and physically.
- SAND·ADD completely eliminates ash contamination of the sand.
- THE IMPROVED VOLATILITY CURVE OF SAND·ADD PRACTICALLY ELIMINATES ATMOSPHERE CONTAMINATION BY GAS, SMOKE, SOOT AND DIRT CHARACTERISTIC OF OTHER PRODUCTS.
- Controlled liberation of gases to mold cavity by decomposition of SAND·ADD prevents casting blows and permits use of low permeability sand.

Change your records. Use the new name . . . DELTA SAND·ADD, when ordering the new, improved-formula Delta Sea Coal and Pitch Replacement. Working samples will be sent to you on request.

- SAND·ADD increases dry strength of sand 75 to 90%.
- SAND·ADD substantially reduces scrap castings by preventing casting defects.
- SAND·ADD cuts cleaning time and costs by improving casting finish.
- SAND·ADD is more economical to use and easier to control than sea coal or pitches.
- SAND·ADD is much cleaner and more foolproof to use than sea coal or pitches.
- On complete decomposition SAND·ADD leaves a total ash of less than .2%.
- SAND·ADD is completely volatile at elevated temperatures.
- SAND·ADD is specially compounded to provide exclusive advantages and contains verified amounts of C, H, O and N.

SAND·ADD has been thoroughly tested in various foundries under a variety of actual conditions and proved superior to every other product tested for the same purpose under similar conditions.

OUR 26TH YEAR

DELTA

DELTA OIL PRODUCTS CORP. | **MILWAUKEE 9, WISCONSIN**

MANUFACTURERS OF SCIENTIFICALLY CONTROLLED FOUNDRY PRODUCTS

Circle No. 149, Page 21 or 79

THE MIX-MULLER

TRADE UP!

Meet the production challenge of the '60s with F Series Mix-Muller

IF YOUR SIMPSON MIXER IS OVER 20 YEARS OLD A MODERN F SERIES MIX-MULLER CAN DELIVER:

- 67% greater Batch Capacity
- 100% more Hourly Production
- 30% more Mulling Efficiency

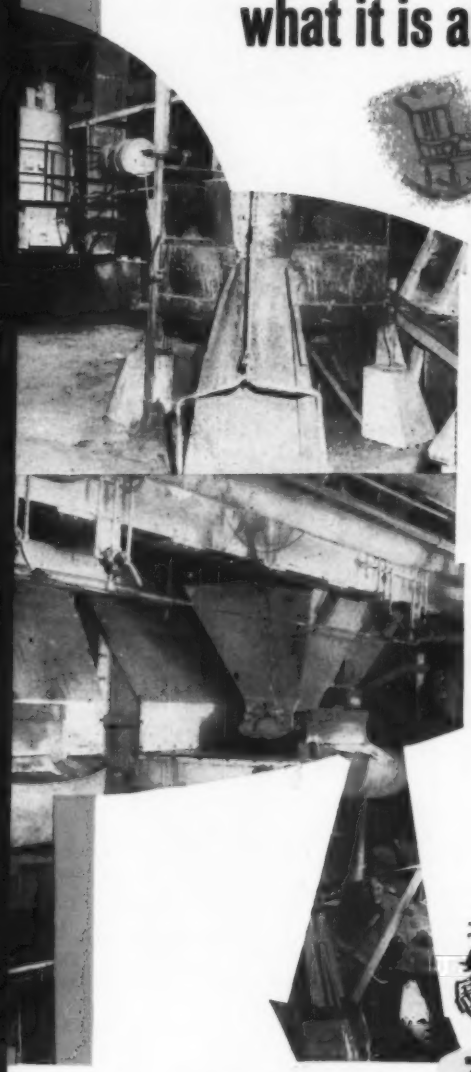
PERFORMANCE

	1930 Simpson	Model F Mix-Muller	
Batch Capacity	1200 lbs. (max.)	2000 lbs. (min.)	67% more
Output Per Hour (G.I. Mold.)	12 tons (max.)	24 tons (min.)	100% more
Discharge Time	40 seconds	20 seconds	50% less
Mulling Efficiency	On basis of time required to develop sand characteristics compatible with modern foundry practice overall 2F efficiency is about . . .		30% greater
Equipment Cost (Per Ton/hr. of Sand Prepared)	Based on present day prices, the 2F Mix-Muller will turn out 100% more sand per hour at an equipment investment amounting to . . .		31% less cost per ton/hr.

MORE PRODUCTION

RETIREMENT PLAN

what it is and how it benefits Mix-Muller users



If your Simpson Mix-Muller was built before 1951, you can now *trade it in* as you would your automobile.

Why a retirement plan? Simply this. There is no comparison between the production efficiency of a 20-year-old Simpson machine and a 1960 F Series Mix-Muller! Many satisfied users are operating Simpson machines which *paid for themselves* over a decade ago. Maintenance and repairs may be negligible on these sturdy mixers. But in the decade since amortization, such a machine may well have *cost* its owner the price of an F Series Mix-Muller . . . in the increased hourly production and overall efficiency he *could* have had, with a modern F Series Mix-Muller.

This is not planned obsolescence . . . it is calculated *progress*. The charts below reveal how a 1960 F Series Mix-Muller *performs* better, is *built* better and is easier to service and operate than *any* muller you may now operate.

The Mix-Muller retirement plan is especially designed to make your transition to an F Series Simpson Mix-Muller easy and economical. Ask your NATIONAL man about it, or write for details.

NATIONAL ENGINEERING COMPANY
630 Machinery Hall Bldg., Chicago 6, Illinois

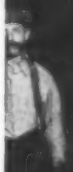
SIMPSON MIX-MULLER

CONSTRUCTION:

	1930 Simpson	Model F Mix-Muller
Muller Suspension	Rocker arms. 3 weights of mullers 700, 1000, 1600 lbs. Manual adjustment. Non-reversible.	Spring loaded—automatically adjusts to provide more pressure as sand increases in strength. Reversible.
Discharge Door	Hand fitted. No adjustment for wear.	Machined to close tolerance and equipped for wear adjustment. 100% larger opening.
Bearings	Sleeve.	Anti-friction throughout.
Drive	Open bevel, direct connected.	V-belt, self-contained, splash lubricated reducer.

SERVICE AND OPERATING:

	1930 Simpson	Model F Mix-Muller
Lubricate	5 alemite fittings.	"One stop" centralized system for all interior components.
Plow Adjust	Wrench and hammer, from inside crib.	Can be adjusted from top of cross head.
Overhaul	Roll up sleeves. Crawl in mixer.	Roll out mullers and/or turret assy. through removable crib section—without dismantling hoods, hoppers, etc.



WHO'S GOT HANDLEBAR HARRY?

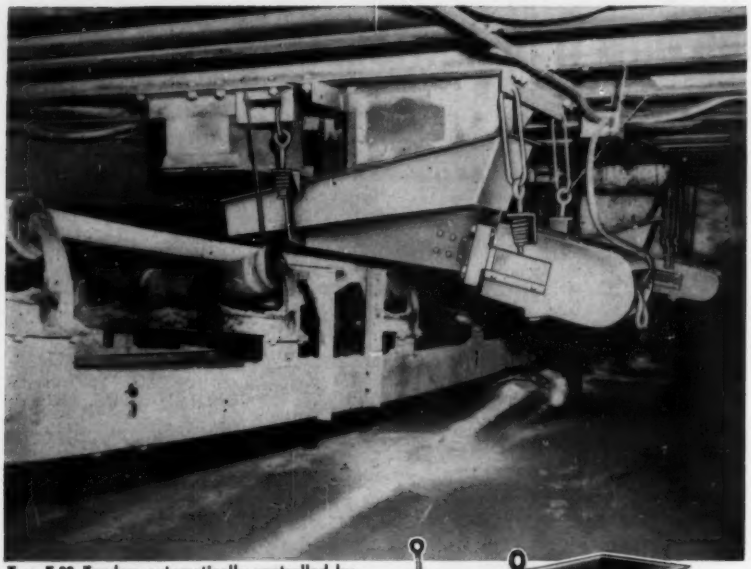
ANY MIX-MULLER USER can enter and win a prize in National's $5000 contest. Write for an entry blank.

BETTER BUILT *EASIER TO SERVICE*

Circle No. 151, Page 21 or 79

Circle No. 151, Page 21 or 79

SYNTRON Vibra-Flow
VIBRATORY FEEDERS



Two F-33 Feeders automatically controlled by load cells in a batch bucket, feeding foundry sand onto a belt conveyor.

increase production, reduce material handling and maintenance cost

SYNTRON Vibratory Feeders provide an efficient high capacity flow of scrap, alloys, sand, and other foundry materials to conveyer belts, screens, ladle streams, molds and other process equipment. Rate of material flow is instantly adjustable over a wide range to meet production requirements.

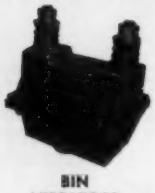
SYNTRON Electromagnetic Vibratory Feeders assure longer, more dependable operation with less down time and maintenance. They are constructed to withstand load shock and excessive wear by abrasion.

SYNTRON'S years of experience in the material handling field qualifies them to act on problems large or small.

Write for complete catalog data

SYNTRON COMPANY
545 Lexington Avenue Homer City, Penna.

Other SYNTRON Equipment of proven dependable Quality



BIN VIBRATORS

HOPPER LEVEL SWITCHES

VIBRATING SCREENS

MECHANICAL VIBRATING CONVEYORS

DRY FEEDER MACHINES

Circle No. 150, Page 21 or 79

future meetings

Continued from page 4

Feb. 24-25 . . Malleable Founders Society, *Technical & Operating Conference.* Cleveland.

March 7-8 . . Steel Founders' Society of America, *Annual Meeting.* Drake Hotel, Chicago.

March 14-18 . . National Association of Corrosion Engineers, *Annual Conference.* Dallas, Texas.

March 16-17 . . Foundry Educational Education, *Annual College-Industry Conference.* Statler-Hilton Hotel, Cleveland.

April 3-8 . . American Chemical Society, *Spring Meeting.* Detroit.

April 13-14 . . Malleable Founders Society, *Market Development Conference.* Edgewater Beach Hotel, Chicago.

April 21-28 . . American Society of Tool Engineers, *Annual Meeting & Tool Show.* Municipal Auditorium, Detroit.

April 24-28 . . American Ceramic Society, *Annual Meeting.* Bellevue-Stratford Hotel, Philadelphia.

April 26-29 . . National Industrial Sand Association, *Annual Meeting.* Key Biscayne, Fla.

May 9-13 . . AFS *64th Annual Castings Congress & Foundry Show.* Convention Hall, Philadelphia.

May 25-26 . . American Iron and Steel Institute, *General Meeting.* Waldorf-Astoria Hotel, New York.

June 6-7 . . Malleable Founders Society, *Annual Meeting.* Elbow Beach Surf Club, Hamilton, Bermuda.

June 16-17 . . AFS *Chapter Officers Conference.* AFS Headquarters, Des Plaines, Ill. and LaSalle Hotel, Chicago.

June 26-July 1 . . American Society for Testing Materials, *Annual Meeting & Exhibit.* Chalfonte-Haddon Hall, Atlantic City, N. J.

Sept. 11-16 . . American Chemical Society, *Fall Meeting.* New York.

Sept. 19-24 . . *International Foundry Congress.* Zurich, Switzerland.

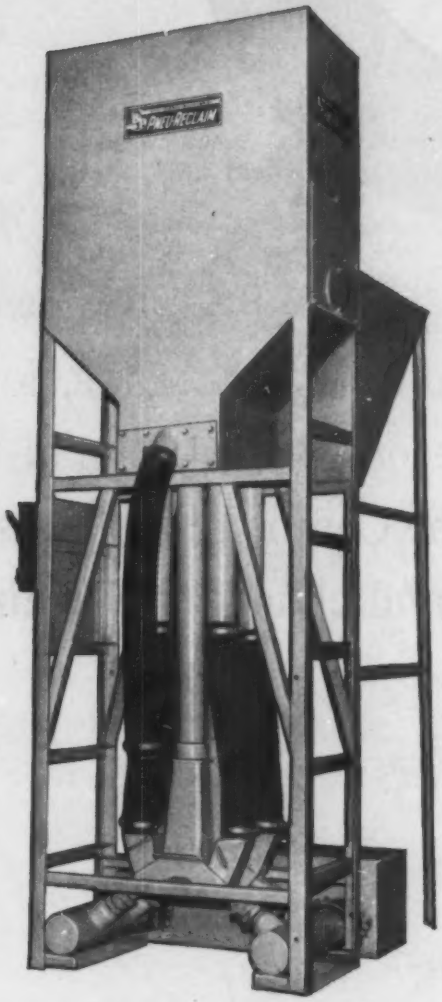
Oct. 12-14 . . Gray Iron Founders' Society, *Annual Meeting.* Netherland-Hilton Hotel, Cincinnati.

Nov. 14-16 . . Steel Founder's Society of America, *Technical & Operating Conference.* Carter Hotel, Cleveland.

AFS Chapter meetings for December appear on page 75.

BETTER BUILT EASIER TO SERVICE
Circle No. 151, Page 21 or 79

IS YOUR FOUNDRY DUMPING OVER $12,000 IN RECLAIMABLE SAND THIS YEAR?



EVEN SMALLER FOUNDRIES DO...

Large expenditures for new sand aren't limited to the larger foundries. Many foundrymen are surprised and even shocked when they calculate the cost of new sand in their foundry operations. One typical medium-size foundry revealed these figures:

Cost of new sand per ton at siding	$5.83
Cost of moving sand to storage, per ton	.65
Cost of storage, per ton	.25
Cost of trucking used sand to dump, per ton	.55
Total cost, per ton	$7.28
Total cost per month (based on 150 tons/month)	$1,092.00

Of course, bigger foundries spend more . . . much more. Yet, the sand hauled to the dump is perfectly reclaimable for use as new sand. The sand dumped represents dollars lost forever . . . dollars that a reclamation unit could save.

NOW—RECLAMATION COSTS LESS

The newest of dry reclamation units—Pneu-Reclaim—actually costs less to install and use than earlier units. Its many exclusive features—dual-jet scrubbing, high recovery fines control, level-flow and simple quantity-quality control—mean lower-cost operation and superior peformance. The typical costs shown below are based on hundreds of actual tests:

Typical cost of reclaiming for reuse in molding sand mixtures, per ton	30c
Typical cost of reclaiming for reuse in core sand mixtures, per ton	90c
Typical cost of reclaiming for reuse in CO_2 sand mixtures, per ton	60c

These costs include all of the charges for power, maintenance and operation. Because Pneu-Reclaim *requires half the air pressure for operation, it consumes half the power required by earlier units.*

AND SAVES MORE!

It's easy to find how much Pneu-Reclaim can save your foundry. Simply compute the actual cost of each ton of sand delivered to your foundry, used in your system and then discarded, and subtract the cost of reclamation. The difference represents the saving offered by Pneu-Reclaim per ton of sand reclaimed and used in lieu of new sand.

TYPICAL EXAMPLE

Cost per ton of sand delivered, used and discarded	$7.28
Cost per ton of sand reclaimed for reuse in molding sand mixtures	.30
Saving per ton	$6.98
Saving per month (based on 150 tons/month)	$1,047.00

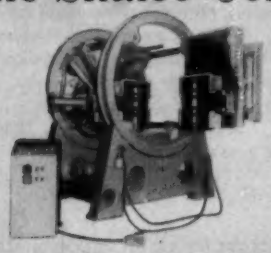
A no-obligation demonstration will prove these facts for you. Write today!

B&P PNEU-RECLAIM

Beardsley & Piper
Div. Pettibone Mulliken Corp.
2424 N. Cicero Ave. • Chicago 39, Illinois

Circle No. 152, Page 21 or 79

The Shalco Corporation, pioneers in Shell Core Blowers and Shell Molding Machines, joins forces and becomes a Division of the National Acme Company, pioneers in automatic multiple-spindle bar and chucking machines



NAMCO

Circle No. 153, Page 21 or 79

The National Acme Company

EXECUTIVE OFFICES: 170 EAST 131st STREET, CLEVELAND 8, OHIO • GLENVILLE 1-9080

To The Foundry Industry:

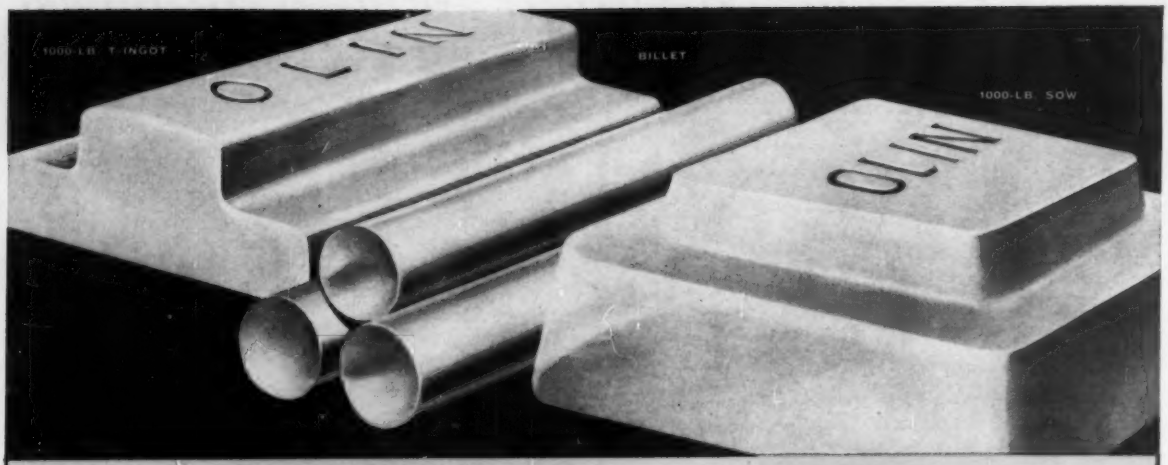
Our "Zone of Responsibility" to the metalworking industry is constantly being broadened to include almost every production step from raw material to the finished product. In joining forces with National Acme, Shalco's exclusive developments and broad experience in the art of shell molding is combined with 75 years' experience in automatic machine tool manufacturing and servicing. The result is shell molding equipment built to the highest standards of machine tool precision and reliability.

Shalco's unique design and manufacturing techniques have resulted in low cost, greatly simplified Shell Core Blowers and Shell Molding Machines with unusual flexibility. We believe this outstanding equipment will now allow the Foundry Industry to take greater advantage of the economy, precision and high quality realized with shell molded castings.

One of the most complete engineering and application services in the industry is available to assist foundrymen everywhere in obtaining optimum results from this outstanding process.

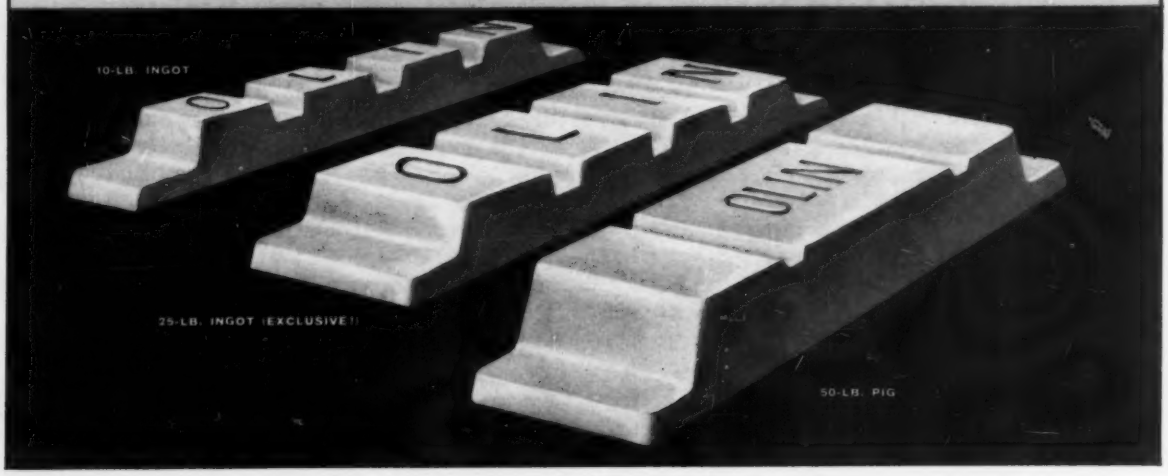
T. L. Stemple

President
The National Acme Company



There's one for your every need

OLIN ALUMINUM PIG, INGOT AND BILLET



FOR EXTRUDERS

Pure pig in 50 and 1000 lb. sizes. **T-Ingot** in 1000 and 1500 lb. sizes. **Billet,** direct chill cast, in standard alloys, diameters and lengths, including log form. (Billet stock is supplied in special bundles to facilitate shipping and handling in your plant.)

FOR FOUNDRIES

Alloy pig and ingot, in standard alloys, in 10, 25 and 50 lb. sizes. (10 and 25 pounders offer exclusive benefits: smaller size to increase handling efficiency and speed melting; deep notches for easier breaking; 4-section design with smaller sections for faster crucible charging.)

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Circle No. 154, Page 21 or 79

RISERLESS CASTINGS

by C. W. GILCHRIST
Cooper-Bessemer Corp.
Mt. Vernon, Ohio

Foundrymen producing ductile iron castings are vitally interested in improving casting yield and reducing shrinkage defects. The practice of the theories presented in this paper has frequently enabled us to produce sound castings without risers.

Our facing sand mixture contains: washed and dried lake sand and a naturally bonded silica sand with 15 per cent AFS clay along with pitch, dextrin, fireclay, western bentonite and corn flour. Our pitch compound is a thermosetting plastic carbon which gives an extremely rigid mold with a dry shear strength of 50 to 60 psi.

MOLD PREPARATION: Practically all our dry-sand molds are rammed by sand slingers to provide molds which, in the unbaked state, registered 90 to 100 AFS hardness. Molds are baked at 650 F, producing a dry-sand mold of extreme rigidity. Dry shear specifications are set at 50 to 60 psi.

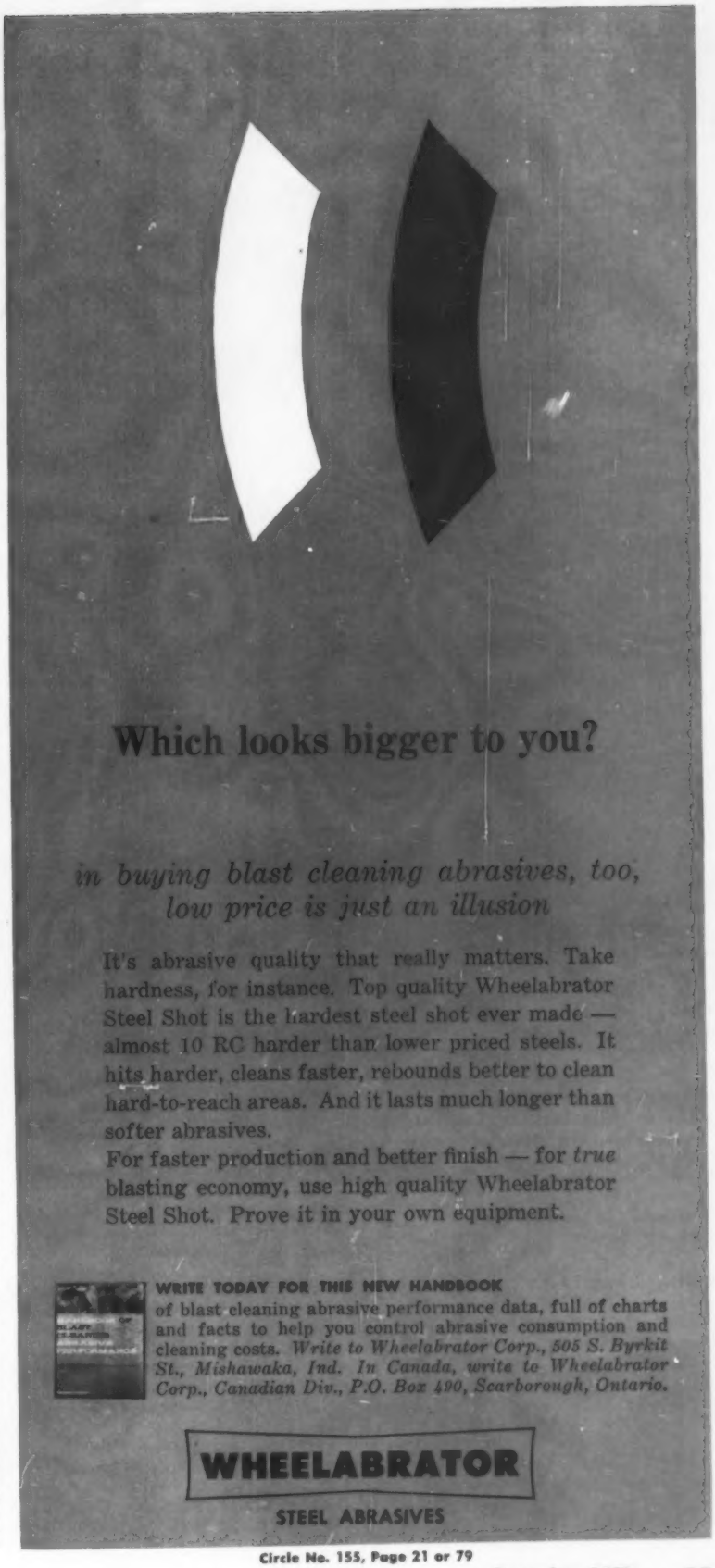
In addition to having a rigid molding material, it is necessary to provide rigid containers. So we use heavy cast iron or ductile iron flasks with reinforcing ribs which allow no possibility of distortion during the casting process or in handling.

SOLIDIFICATION: The final consideration in riserless castings takes advantage of the uniform solidification of ductile iron. Rapid pouring plus gating into a thin section of a casting results in uniform temperature throughout the casting. We have found that it is advantageous to have the complete casting solidify at one time to control gross shrinkage. In the case of castings with extreme section variations, chills are employed.

On heavy castings weighing up to 32,000 lb we have almost universally adopted the practice of casting without risers. We find it extremely important to pour molds rapidly.

CONCLUSION: Cooper - Bessemer Corp. success with riserless ductile iron castings depends on: 1) metal composition adjusted to take maximum advantage of graphite precipitation, to minimize metal shrinkage; 2) molds of maximum rigidity rammed firmly in suitable sand within strong flasks; and 3) rapid pouring through gates into thin sections to minimize temperature gradients.

This article contains highlights abstracted from a paper presented at the 1959 Penn State Foundry Conference.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in buying blast cleaning abrasives, too, low price is just an illusion
It's abrasive quality that really matters. Take hardness, for instance. Top quality Wheelabrator Steel Shot is the hardest steel shot ever made — almost 10 RC harder than lower priced steels. It hits harder, cleans faster, rebounds better to clean hard-to-reach areas. And it lasts much longer than softer abrasives.
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WHEELABRATOR
STEEL ABRASIVES
Circle No. 155, Page 21 or 79

A. L. Hunt

W. Bassett

W. T. Gettig

J. Swartout

P. C. DeBruyne

A. D. Barczak

let's get personal

Albert L. Hunt . . . has been appointed executive vice-president of Superior Foundry, Inc., Cleveland, effective Nov. 1, as announced by W. L. Seelbach, president and board chairman of Superior and its recently acquired Allyne-Ryan division. Hunt formerly served as vice-president in charge of operations of National Bearing Div., American Brake Shoe Co., St. Louis.

Active for years in foundry association work, Hunt served as national director of AFS 1951-1954, and is a past chairman of the Society's St. Louis Chapter. For several years he was chairman of the Foundry Educational Foundation's industrial advisory committee for the University of Missouri School of Mines and Metallurgy, Rolla, Mo.

A native of St. Louis, Hunt attended Washington University there and was associated with American Brake Shoe for 23 years. Starting in the plant engineering department of National Bearing in 1936, he served successively in sales engineering, general machine shop supervision, plant superintendent, works manager, industrial sales manager, and vice-president of operations.

Warren Bassett . . . has been named as manager of sales for the aircraft-missile industry in the southwestern district for Electric Steel Foundry Corp., Portland, Ore. He will headquarter in Los Angeles.

W. Thomas Gettig . . . assistant to the vice-president of Rockwell Mfg. Co., Meter & Valve Div., has been named vice-president and general manager of LFM Mfg. Co., Atchison, Kans., a wholly-owned subsidiary. Gettig will headquarter in Atchison and will be responsible for LFM activities at Atchison and St. Joseph divisions.

Charles S. Anderson . . . has been re-elected as chairman of the board and named chief executive officer and **R. James Swartout** has been elected president of Belle City Malleable Iron Co. and Racine Steel Castings Co., its wholly-owned subsidiary. **Bernard H. Regenburg** was re-elected vice-president, secretary and treasurer. All directors were re-elected to office. Appointments include **Hubert C. Cunningham** as assistant secretary and **Robert D. Leutner**, assistant treasurer.

Philip C. DeBruyne . . . has been elected president, Moline Malleable Iron Co., St. Charles, Ill., succeeding **Gorton Fauntleroy** who becomes chairman of the board. DeBruyne has been associated with Moline Malleable for 23 years, becoming a vice-president in 1949.

Alexander D. Barczak . . . has been named operational vice-president, Superior Foundry, Inc., Cleveland. He has been plant manager at Superior for the past ten years and was recently elected to the board of directors.

Anthony B. Ascik . . . is director of metallurgical technical services, Tennessee Products & Chemical Corp., Nashville, Tenn. He was formerly technical director of Pittsburgh Metallurgical Co. Tennessee Products is a subsidiary of Merritt-Chapman & Scott Corp. of New York.

Harry D. Stone . . . has been named, manager, sales and marketing of the Metals Div., Kelsey-Hayes Co., New Hartford, N. Y. Stone was formerly equipment sales manager for NRC Equipment Corp., Newton, Mass.

Byron K. Hartman . . . has been appointed executive vice-president and sales manager of Syntron Co., Homer City, Pa. Hartman has been sales manager of the Link-Belt Co. Colmar plant and employed by the parent company since 1937.

Joseph G. Solari . . . has been appointed vice-president in charge of sales for the Great Lakes Carbon Corp. carbon division and will be located in New York. He was previously vice-president and a director of Sterling Precision Corp., Port Washington, N. Y.

Harry Ratkowski . . . has been named manager of sales, castings and high alloy products in the midwest and lower Atlantic seaboard for the central sales district of Electric Steel Foundry Co., Danville, Ill. Gene Ottarski will replace Ratkowski as officer manager in the central sales district.

R. C. Brock . . . industrial division manager, has been elected vice-president of Joseph Dixon Crucible Co., Jersey City, N. J. and heads the parent company's industrial division. Brock joined the Dixon organization in 1948 and was promoted to industrial sales manager in 1955.

Fred I. Johnson . . . is now sales engineer for Foundry Equipment Co. in northern Indiana and northern and eastern Illinois. He will headquarter in Elmhurst, Ill.

Joseph Neville, Sr. . . . has retired from Eastern Malleable Iron Co., Wilmington, Dela. after 50 years service.

William H. Dotter . . . and **Walter L. Bardeen** have been named as new marketing executives by the General Electric Co. foundry department. Dotter, located at the company's Everett, Mass., foundry will handle with internal and external sales. Bardeen at the Elmira foundry replaces S. J. Updyke on internal sales. Updyke has been assigned to external sales.

Ernest E. Zimmerman . . . has been named general superintendent, Iowa Malleable Iron Co., Fairfield, Iowa. He was formerly assistant superintendent and metallurgist with Electrocast Steel Foundry, Cicero, Ill.

H. M. Patton . . . AFS Regional Vice-President, has been advanced from works manager, American Hoist & Derrick Co., St. Paul, Minn., to vice-president.

L. Richard Malley . . . has been appointed advertising manager of Climax Molybdenum Co., Div. American Metal Climax, Inc. He will co-ordinate advertising, publicity and sales promotion of Climax's product departments. He was formerly assistant to the president of American & Foreign Enterprises, Inc.

George O. Pfaff . . . has been named director of marketing for Wheelabrator Corp., Mishawaka, Ind. In addition to his current function of supervising abrasive sales, he will be responsible for marketing Wheelabrator's general products and Techline Div. equipment and supplies.

Elmer A. Rich III . . . formerly general sales manager of Wheelabrator Corp., has been named vice-president and general manager of Lake Erie Machinery Corp., Buffalo, N. Y., recently acquired

Continued on page 16

STANDARD FERROMANGANESE • MEDIUM CARBON FERROMANGANESE • SILICOMANGANESE • EXOTHERMIC FERROMANGANESE
MANGANESE BRIQUETS • SILICOMANGANESE BRIQUETS • 2" x 8 MESH • 2" x ¼" • 8 MESH x DOWN • 75= x 2"
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Manganese
54.94
CRYSTAL
a β γ
SHELLS
N 2
M 13
L 8
K 2

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No single manganese alloy is right for all irons and melting conditions. Rather, specific manganese alloys and sizings have been developed which provide maximum economy and effectiveness for specific applications.

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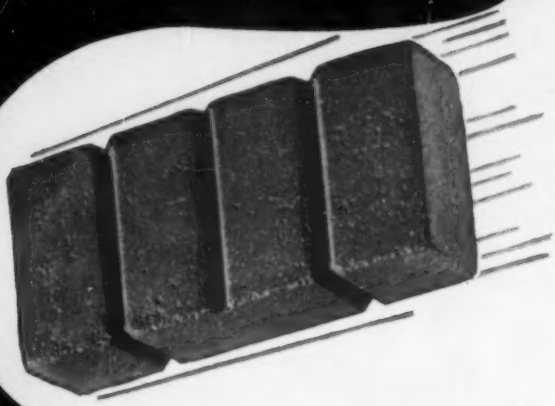
QUALITY DEPENDABILITY SERVICE

Ohio Ferro-Alloys Corporation
Canton, Ohio

Circle No. 156, Page 21 or 79

Cleaner Iron = Greater Profits!



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for Gray Iron and Malleable Iron Foundries

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Circle No. 157, Page 21 or 79

let's get personal

Continued from page 14

subsidiary of Wheelabrator Corp. **John M. Wolf,** controller of Wheelabrator Corp., has been named as treasurer of the Lake Erie firm. **J. F. Connaughton** is functioning as president and director of both Wheelabrator and Lake Erie Machinery. **Robert E. Dillon,** formerly president of Lake Erie Machinery has retired and is chairman of the company's executive company.

Donald K. Ballman . . . and **C. B. Branch** have been named as vice-presidents of Dow Chemical Co., Midland, Mich. Ballman is director of sales and Branch is manager of overseas operations. Both are Dow directors. **Robert B. Bennett** has been named as treasurer and **Fred H. Brown** to the new post as company controller.

William L. Wettlaufer . . . has joined C. O. Bartlett & Snow Co., Cleveland, as a consultant. The Wettlaufer product line, consisting of vibratory screens, packing units, blenders, granulators and centrifuges, was recently purchased by Barlett & Snow.

Alvin R. Arrick . . . has been elected secretary of Herman Pneumatic Machine Co., Pittsburgh, Pa.

A. R. Arrick

L. O. Hofstetter

L. O. Hofstetter . . . president, Brumley-Donaldson Co., Huntington Park, Calif., founder and past chairman of the AFS Southern California Chapter, is now on a six-month consulting assignment with Acinfer, S. A., Villa Constitucion, Argentina, covering foundry sand techniques as well as training of local personnel.

Charles S. Anderson . . . has been re-elected chairman of the board and named chief executive officer and **R. James Swartout** has been elected president of Belle City Malleable Iron Co. and Racine Steel Castings Co., its wholly-owned subsidiary. **Bernard H. Regenburg** was re-elected vice-president, secretary and treasurer.

Chester E. Grigsby . . . vice-president and director of American Steel Foundries and general manager of its Transportation Equipment Div., has been head of

Continued on page 18

A Timely Message for Foundry Managements

MODERNIZATION
MECHANIZATION
AUTOMATION

Knight Engineering has assisted in the modernization, mechanization and automation of hundreds of foundries, here and abroad. These programs have increased production per man hour, established equitable rate structures and eliminated overtime. Specific programs are based on the individual requirements of the foundry and include the degree of modernization, mechanization and automation that is economically justified. Many projects permit direct labor and material cost reductions to amortize the investment in 2 or 3 years. Knight Professional Foundry Engineering is readily available to assist in planning your modernization program.

KNIGHT SERVICES INCLUDE:

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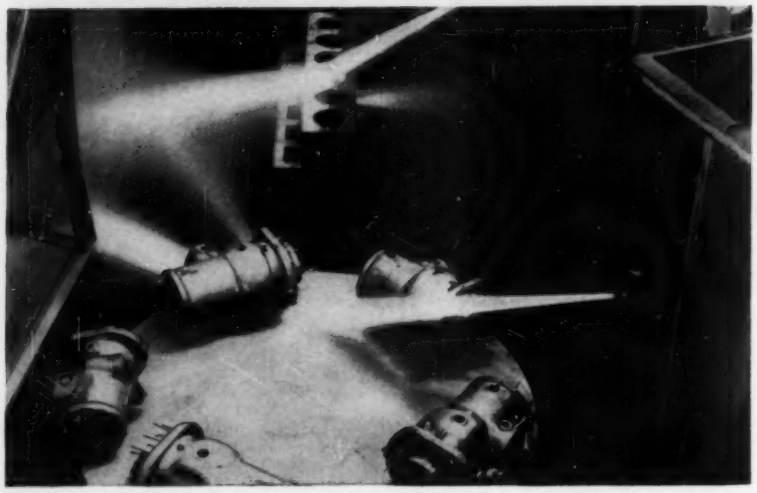
Circle No. 138, Page 21 or 79

HYDRO-BLAST

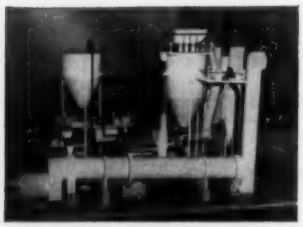
works wonders with sand!



Knocks out cores, cleans castings in a fraction of usual man hours

With Hydro-Blast Equipment, one man can clean the largest, most complicated castings in a fraction of the usual time. Heavy, intricate cores are knocked out—all casting surfaces are de-scaled, left exceptionally clean. The process is completely dustless. Hydro-Blast installations pay for themselves quickly through better, faster cleaning, more healthful working conditions.

Recent Hydro-Blast installations: General Electric Co., Schenectady, N.Y. . . . Gould Pump Co., Seneca Falls, N.Y. . . . Bethlehem Steel Co., Sparrows Point, Md.



Hydro-Blast Wet Sand Reclamation Units

Cleaner, good-as-new core and molding sand, with fully controlled classification. *Recent installations: General Electric Co., Schenectady, N.Y....American Radiator & Standard Sanitary Co., Buffalo, N.Y.*

Hydro-Blast Dry Sand Reclamation Units

Recent installations: Farrell Birmingham Co., Ansonia, Conn. . . . Adirondak Steel Foundries, Watervliet, N.Y. . . . Amsco, Chicago Hts., Ill. . . . Midcontinent Steel Castings Co., Shreveport, La.

A-M

HYDRO-BLAST DIVISION
GUARDITE
● WHEELING, ILLINOIS
DIVISION of AMERICAN-MARIETTA COMPANY

Circle No. 159, Page 21 or 79

let's get personal

Continued from page 16

the division succeeding **Charles L. Heater** who retired. Grigsby has been with American Steel Foundries for 36 years. In addition to being a director of American Steel Foundries, he is a director of Griffin Wheel Co., Griffin Steel Foundries, Ltd., Pipe Line Service Corp., South Bend Lathe, Inc., all subsidiaries of the parent company.

obituaries

Walter J. Temple, 56, works manager for K O Steel Castings, Inc., San Antonio, Texas, died Sept. 20 at San Antonio.

W. J. Temple

Temple had been works manager since 1946 and was superintendent from the formation of the company in 1938 until his advancement. He had also been employed by Temple Foundry, San Antonio, Texas; Texas Electric Steel Castings Co., Houston, Texas; American Well & Prospect Co., Corsicana, Texas and Diebert, Bancroft & Ross, New Orleans, La. Temple had been active in activities of the Steel Founders' Society.

Niles L. Kohler, 68, formerly with American Chain & Cable Co., York, Pa., and manager of the malleable foundry until his retirement in 1958, died in October.

Max Sorrenson, Jr., 33, a partner with his father in Sorrenson Engineering Co. in suburban Philadelphia, died recently.

N. F. Galgiani, founder of the firm of Snow & Galgiani, died Sept. 28. He was a member of the Northern California Chapter and had been associated with the foundry industry since 1911.

Robert O. Tucker, 46, died at his home in Indianapolis during September. He had been employed for 18 years as a laboratory worker for International Harvester Co. and was the official photographer for the AFS Central Indiana Chapter.

A. J. Heysel, Chairman of the Western New York Chapter, died Nov. 12. He was Eastern manager, E. J. Woodison Co., Buffalo, N.Y. Heysel had been active in AFS chapter activities for many years.

Provide maximum protection in the cupola melt zone with Goose Lake FIROX CUPOLA MIX

FIROX Cupola Mix is made of high purity silica, in a carefully balanced screen distribution, and a blend of fine clays. FIROX is the ideal refractory for the melting zone as it produces a strong monolithic lining with a maximum on-the-wall density. It expands under temperature and forms a surface glass to seal out slag and fluxes and retain its refractoriness. It is resistant to high temperatures, air blast, corrosive slags and other fluxing agents. FIROX is produced under strict quality control standards to insure thorough coating and proper sizing of the aggregates. FIROX is easily applied by hand or by air gun . . available in bulk or 100 lb. bags. Write today for information.

FIROX cupola and ladle mix provides extra high resistance to acid slags and erosive action of the molten metal. FIROX improves lining life and reduces melting costs.

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Circle No. 160, Page 21 or 79

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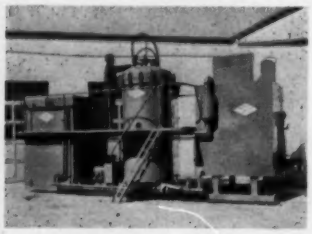
new products and processes

BATCH TYPE IMPREGNATOR . . . available on rental basis for use with aluminum automotive transmission housings handles up to 70 large castings per hr. Designed specifically for use with metal oxide sealing materials. Separate elec-



tronic control panel automatically phases the impregnation cycle and includes interlock which prevents entry of the liquid sealing material into any part of the vacuum system. Prenco Mfg. Corp

For More Information, Circle No. 1, Page 21

SELF-CONTAINED CAR-BOTTOM FURNACES . . . requires neither rails nor pits below floor level and may be moved intact. Car is motor driven by rack and pinion gear, additional wheels

pick it up as it runs inside the furnace. Water-cooled shaft permits operations at 1800 F. Furnace measures 3x3x6 ft. Heating elements draw maximum of 100 kw. Waltz Furnace Co.

For More Information, Circle No. 2, Page 21

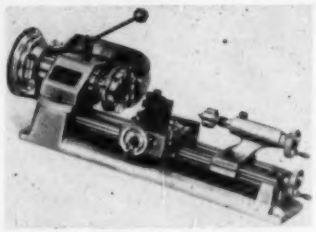
NON-SILICA PARTING POWDER . . . chemically inert, used to part core and molding sands for all metals. Useful where core boxes and patterns have little draft when core and molding sand contain ingredients making sand sticky, and in drawing CO_2 cores from boxes. Applied by shaking from mesh shake-bag. Said to weigh 60 per cent less than similar products. Waterproofed and extremely fine, it adheres to vertical surfaces of wood, metal, plastic and other materials. Frederic B. Stevens, Inc.

For More Information, Circle No. 3, Page 21

2000 F PUMP . . . air-operated, free-piston type, pumps molten metals up to 2000 F and other materials without pulsating, surging, noise and vibration. When stoppage occurs, pump halts operations. Can be installed in areas formerly considered inaccessible or too dangerous for gasoline or electric-powered pumps. Crossley Machine Co.

For More Information, Circle No. 4, Page 21

EXPERIMENTAL SHOP MACHINE . . . makes machined-to-scale models with tolerances to 0.004 in. Basic unit can be set up as lathe, drill press, milling machine, toll grinder, polisher and



hand drill. Other attachments include jigsaw, table saw, threading attachment, indexing and dividing attachment. American Edelstaal, Inc.

For More Information, Circle No. 5, Page 21

OIL-RESISTANT GLOVES . . . retain dexterity, grip and light weight through impregnation of oil-repelling chemical. Reversible for increased life. Terry cloth cushions hands against sharp edges and rough surfaces. Jomac, Inc.

For More Information, Circle No. 6, Page 21

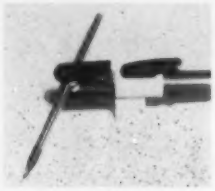
SAND CASTING PROCESS . . . said to produce smoother finish and closer tolerance. Castings may be made in gray and ductile iron. Advance Foundry Co.

For More Information, Circle No. 7, Page 21

INFRA-RED SPACE HEATERS . . . operating on bottled propane gas use polished parabolic reflectors to concentrate on specific areas without heating surrounding air. Available in three sizes from rated output of 16,000 to 36,000 Btu with hourly cost said to be 5-15 cents. May be used for spot heating, thawing, curing, drying or baking. Perfections Industries, Div. Hupp Corp.

For More Information, Circle No. 8, Page 21

GOUGING TORCH . . . features push button air control valve in torch handle for easy reversal of travel direction in



removing flashes of cutting holes. Requires only compressed air and welding current for cutting and removing metal. Arcair Co.

For More Information, Circle No. 9, Page 21

DIE CAST MOLD RELEASE OIL . . . reportedly prevents adhesion of casting metal to mold, gives bright, stain-free surfaces and reduces porosity. Oil, applied by spray, develops comparatively less fog and minimizes wear on guide pins and bushings. Sun Oil Co.

For More Information, Circle No. 10, Page 21

BATCH LOADING COSTS CUT . . . by lifting and dumping unit which handles drums and bags. Available in capacities to 400 lb and dumping heights to 12 ft in stationary or portable models. Conveyors & Dumpers, Inc.

For More Information, Circle No. 11, Page 21

FIBER & STEEL DRUM . . . handler attachment for fork lift trucks provides

additional versatility to existing equipment. Little Giant Products, Inc.

For More Information, Circle No. 12, Page 21

MARKING PENCIL . . . all-purpose pencil of normal pencil size, writes on any surface. Not a paper-wrapped grease pencil, use pencil sharpener to make point. J. S. Staedtler, Inc.

For More Information, Circle No. 13, Page 21

PNEUMATIC TEMPERATURE CONTROL . . . is a differential expansion type suitable for operation at temperatures up to 2000 F. Provides air pressure proportion to temperature and used

for direct operation of air-operated diaphragm valves, motors, dampers, or similar equipment. Burlington Instrument Co.

For More Information, Circle No. 14, Page 21

FASTER GRAPHITIC CARBON ANALYSIS . . . achieved by filtering directly into porous, disposable filtering crucible. After washing and drying, iron chips and tin accelerator are added directly and crucible is introduced in-

to high frequency furnace equipped with either a gasometric or gravimetric carbon analysis train. Graphitic carbon is then determined and filtering crucible thrown away. Laboratory Equipment Corp.

For More Information, Circle No. 15, Page 21

AUTOMATIC SUSPENSION SCALE . . . has reset knob so that weight of slings, pallets or chains may be easily canceled. Scales weigh 56 lb, are temperature compensated so unaffected by

extremes of foundry heat or sub-zero or outside storage yards. In addition to hoist or crane operations, may also be utilized on cross-bar of fork lift trucks. Calibrated to 1/10 of 1 per cent. W. C. Dillion & Co.

For More Information, Circle No. 16, Page 21

BOOSTER COMPRESSOR . . . delivers 590-1180 cu ft of air per min through long lines at 100 psi. Designed to operate on minimum intake pressures of 45 psi; air-cooled, double-acting, single-stage construction. Valve designs result

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9	21	33	45	57	69	81	93	105	117	129	141	153	165	177	189	201	213	225
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in lower than normal discharge velocities with lower air temperatures. Atlas Copco.

For More Information, Circle No. 17, Page 21

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cent higher than two batch mixers of equivalent size by eliminating charge and discharge time, mixing time required for pre-mull dispersion or tempering. Recommended for gray iron, steel and nonferrous sands. National Engineering Co.

For More Information, Circle No. 18, Page 21

PORTABLE GAS HEATERS . . . for spotting in large isolated areas available in three models from 160,000 Btu/hr to 480,000 Btu/hr operating on any type of gas at pressures from 6 oz to 2 psi. Single unit, 72-in. high, occupies 28 in. of floor space. Union Chill Mat Co.

For More Information, Circle No. 19, Page 21

SNOW PLOW ATTACHMENT . . . for powered-wheelbarrow rolls snow off to side. While 50-in. blade is in use, 10 cu ft bucket can be filled with ballast

or sand for spreading on icy areas. Blade attachment, bucket and flatbeds are quickly interchangeable. Prime-Mover Co.

For More Information, Circle No. 20, Page 21

APTITUDE TESTS . . . give scientifically reliable index of intelligence, personality traits, specific job aptitudes, and abilities as an aid to more effective hiring, placing, instructing and promoting of personnel. For workable sample of tests circle number below. Aptitests.

For More Information, Circle No. 21, Page 21

NOISE KILLER . . . vinyl plastic and fiber glass machine mounting pads are said to eliminate tremors and noise. Lowell Industries, Inc.

For More Information, Circle No. 22, Page 21

model HAH PAYLOADER® "the most economical loader ever used in this work"*

*Says J. A. Merritt, Night Foreman of Dewey Bros., Inc. foundry at Goldsboro, N. C., "it has given over 3 years of continuous service with only 3 nights lost time. It has proven to be the most economical loader ever used in this work. 'PAYLOADER' tractor-shovels are designed and built for maximum production output under adverse work conditions."

This 74-year old foundry has three "PAYLOADER" models, the first purchased six years ago. They are used to carry new castings from the pouring floor to the cleaning room, to scoop sand from the floor and deliver it to the shaker, to deliver sand from the mullers to the sand cutter, and to do miscellaneous handling work.

Whether your needs are for outdoor or for indoor work, for unloading box cars of bulk materials or large-tonnage stockpile operations, there's a dependable "PAYLOADER" tractor-shovel available including 4-wheel-drive models up to 12,000 lb. carry capacity, plus many useful attachments. Your Hough Distributor is ready to serve you with complete sales, service and parts stocks.

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Circle No. 161, Page 21 or 79

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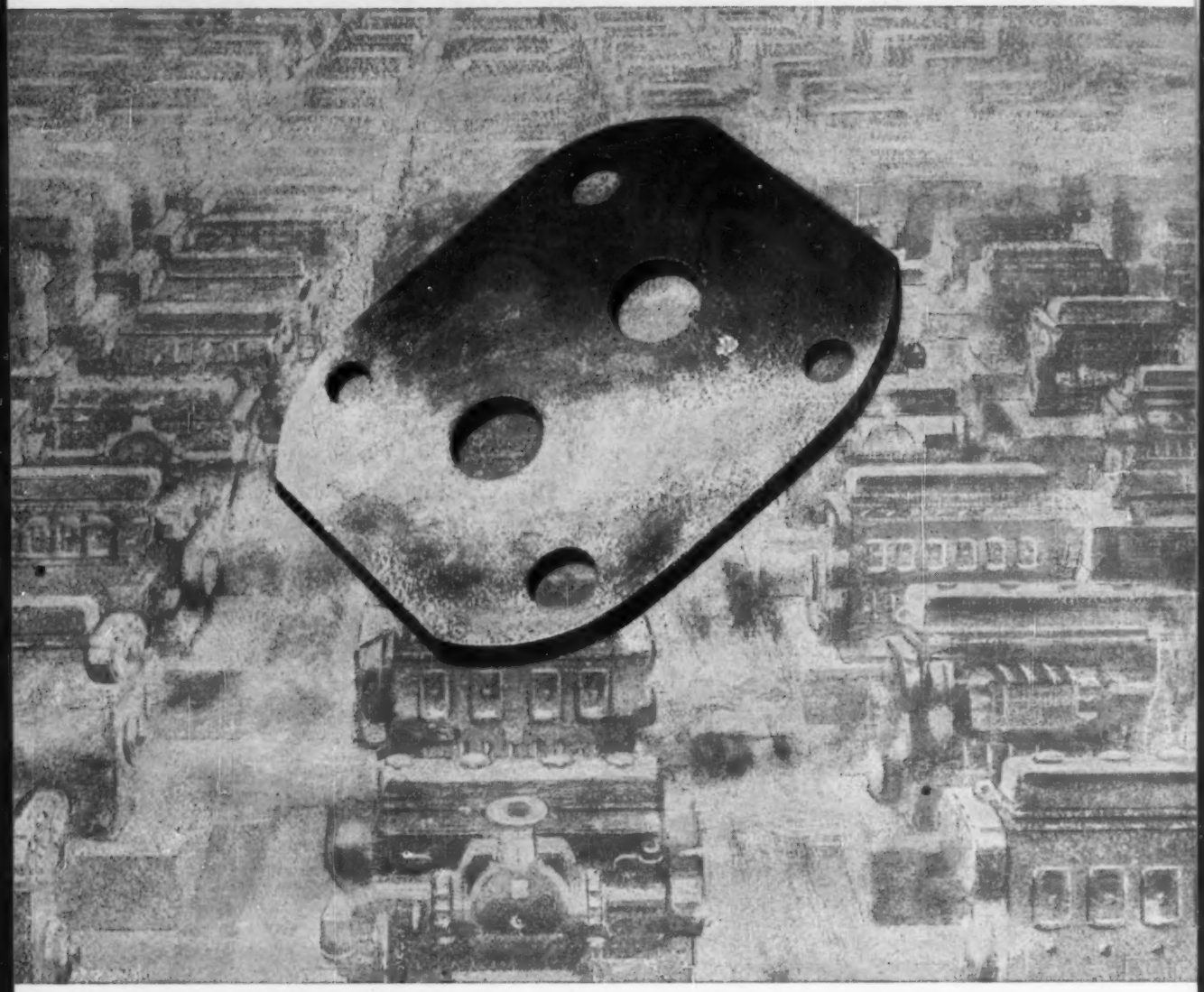
How the Foundry Industry Serves America . . . #3 of a Series



88% COST SAVINGS EFFECTED BY CAST IRON SPACER PLATE

Spacer plates in diesel engine oil pumps used to be made of soft steel stampings. However, because of manufacturing difficulties and resultant high costs, an interchangeable gray iron casting was developed and recommended.

The results were completely satisfactory from every standpoint. Surface-ground on both sides, the iron casting was delivered at one-third the cost. And because it eliminated eight in-plant operations, this initial saving was raised to a total of 88%.

This is another example of how modern iron castings can reduce costs and solve many of the problems of industrial product design.

Hanna Furnace provides foundries with all regular grades of pig iron . . . foundry, malleable, Bessemer, intermediate low phosphorus, as well as HANNA-TITE® and Hanna Silvery.

Facts from files of Gray Iron Founders' Society

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Circle No. 162, Page 21 or 79

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Circle No. 163, Page 21 or 79

pouring off the heat

comments on work simplification

■ I have read with a great deal of interest the recent article appearing in MODERN CASTINGS, "Work Smarter . . Not Harder," and congratulate the contributing foundry and MODERN CASTINGS on providing such pertinent information to the foundry industry.

While we do not carry this work simplification program near to this extent, we wholeheartedly agree with it and are laying our plans to follow a similar method.

In general I think MODERN CASTINGS has provided its readers some excellent material in the past few months and I commend you and your staff on a job well done.

M. J. Henley
Tyler Pipe and Foundry Co.
Tyler, Texas

■ I certainly enjoyed reading Jack Irish's article, "Work Smarter . . Not Harder," in MODERN CASTINGS. The entire work simplification program initiated by the Texas Foundries is well organized. It has the direct appeal necessary to both the employee and the supervisor because of the common sense approach to the improvement project, taking into full consideration the human relationship involved. Obviously, in addition to the profitable returns experienced by the Texas Foundries, they have enhanced the position of the foundry in industry by means of a cleaner, more efficient operation.

We have had in use the suggestion system at Alloy Steel Casting Co. for several years. Our system operates as follows:

1) Suggestion boxes are conveniently located throughout the plant; alongside each box are "Suggestion Forms." When an employee decides a money-saving project is possible, he lists the details on his suggestion form which he gives to his foreman for approval and signature.
2) The suggestion then goes to a suggestion committee, consisting of: a) personnel manager, b) industrial engineer, c) supervisor selected from one department, d) supervisor from suggestor's department. If the suggestion is approved, the project is performed with the assistance of the department, if necessary.
3) For accepted suggestions the suggestor will be paid 50 per cent of the first year's net saving to the company as his award. If rejected, the suggestor will be told why in writing. The minimum award for an accepted suggestion is $5.00; the maximum initial part-payment of an award is $100. The balance will be paid quarterly on the basis of cost accounting computation of actual savings.

The above suggestion system coordinated with our individual performance check sheet and departmental comparative performance ratings has proved economical and efficient for our small number of employees (80).

Our ultimate goal is the same as the Texas Foundries, although the methods are not exactly the same; our smaller number of employees allows our supervisors to provide on-the-job training.

Donald J. Volk
Alloy Steel Casting Co.,
Southampton, Pa.

■ "Work Smarter . . Not Harder," we all agree is a fine article and well presented. The author seems to have his program well organized and getting amazing results.

Minneapolis Electric has been trying to operate for some time on the theme of working smarter and not harder. We conduct meetings to solve problems and try to pull ideas from as many heads as possible. We have met with considerable success although there is still a great deal of room for improvement in our thought-provoking program.

One stumbling block in the development of foundry operations everywhere has been our over-anxious desire to attack a problem more with a strong back than with a strong mind. This is an ancient habit within our industry. In many instances we have bullied our way through a difficult situation when actually there was a much simpler and easier solution which would have been more efficient. The former approach has been too often prevalent and excessively costly to our industry.

Carter DeLaittre
Minneapolis Electric Steel Castings Co.,
Minneapolis.

INCO gift

■ As a result of the announcement in the April issue of MODERN CASTINGS that the Polytechnic Institute of Brooklyn would like to acquire a melting furnace, the International Nickel Co., Research Laboratory, Bayonne, New Jersey, donated an Ajax furnace that meets our needs.

On behalf of the Polytechnic Institute of Brooklyn, the Metropolitan Chapter AFS and myself, I thank you very much for giving our request the attention that brought results.

William H. Ruten
Polytechnic Institute of Brooklyn,
Brooklyn, N. Y.

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763 **Sales Representatives,** Dealers, Jobbers and Wholesalers of primary sources.
3296 **Trade Names** of Products used by the Metal Castings industry and their primary sources—alphabetically.
492 **Trade Names** classified by Products, and their primary sources.
41 **Foundry Supply Houses,** keyed to all the Products they supply.
133 **pages** of Catalog Advertising prepared specially for the Buyers Directory.
42 **pages** of data on the 12 major Foundry Associations and their services.

Every Foundry in the U. S. and Canada will receive at least one copy gratis. World-wide distribution has been arranged. The 2d edition will be published in fall of 1961.

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"UNITIZED CONTROL SYSTEM" PACKAGE *designed for automatic operation. One push button on the operator's control panel starts operation sequence, determined by process requirements. At center, component control cabinet, mounted outside of oven, features swing-out panel for easy maintenance of system.*

...factory PREWIRED and TESTED for cost-saving installation

● *"Unitized Control System" reduces and simplifies job-site wiring of instrumentation of ovens used in foundry core-baking and heat treating.*

Designed and built into a compact package, the "Unitized Control System" is a systematic arrangement of electrical controls, neatly wired to a terminal board for simple and easy connection to oven-mounted components. Because all electrical components are prewired and tested at the factory, Hevi-Duty assures reliability of control for continuous oven operation. A schematic wiring diagram, furnished with each control system, clearly shows each terminal of all controls. This, too, helps minimize installation and maintenance costs.

With "Unitized Control," you can be sure of a precise control system flexible in design . . . easy to maintain . . . neat in appearance.

A typical "Unitized Control System" for ovens consists of: cover interlock disconnect, when required by code; fuse for each phase of heater, motor and control circuits; thermal-overload protected starter for each motor, with thermal-overloads connected in series to coil of control relay; purge timer for all control systems involving combustible products or fuels; a flame-fail relay for each fuel-fired burner; sequence relays and timers for all processes involving automatic sequence of operations, and control transformer.

"Unitized Control System" is standard on all Hevi-Duty industrial ovens. For more information contact Hevi-Duty.

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HEVI-DUTY ELECTRIC COMPANY, MILWAUKEE 1, WISCONSIN

Industrial Furnaces and Ovens, Electric and Fuel • Laboratory Furnaces • Dry Type Transformers • Constant Current Regulators

Circle No. 165, Page 21 or 79

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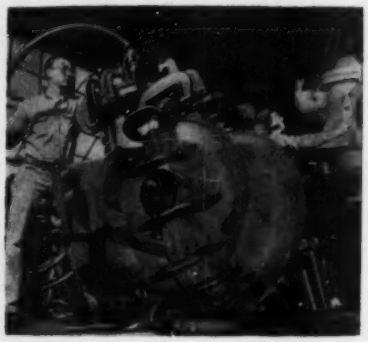
Circle No. 166, Page 21 or 79

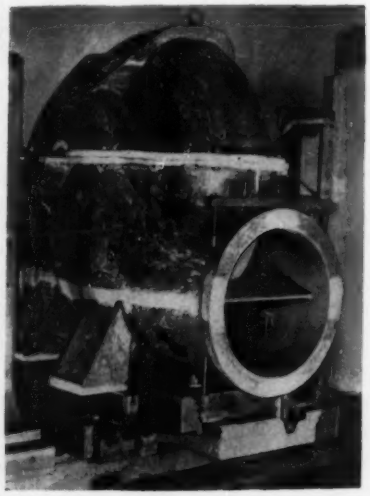
here's . . . . . how

. . . **National Bearing Div., American Brake Shoe Co.,** Meadville, Pa., met the needs for sea-water pumping with a zincless bronze 5000-lb pump



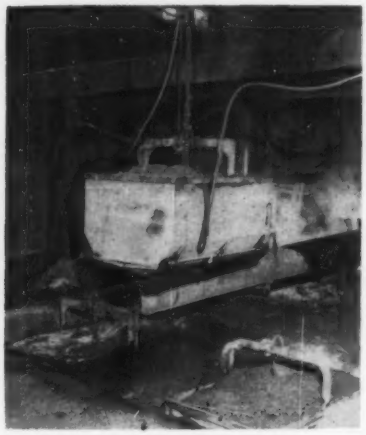
housing. The units are 18-in. "bottom suction" castings and are shown ready for leak testing with steam pressure.

. . . **Chambersburg Engineering Co.,** Chambersburg, Pa., uses the cement bonded sand method to cast a 24,200-lb, 14 ft high, gray iron pump cast-



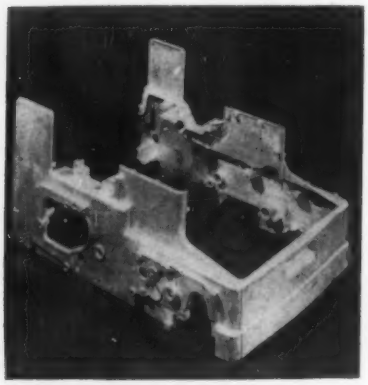
ing. Castings were made in two pieces and will become integral part of a 36-in. horizontal water circulating pump.

. . . **Woodruff & Edwards Inc.,** Elgin, Ill., built their own cupola slag handling equipment. Swinging pipe carries mixture of water and granulated slag from cupola slag trough to a concrete pit behind. Pit accommodates three tote boxes which hold about 500 lb of slag each and fill in about



20 minutes. When filled, overhead hoist raises box and positions it for unloading. Bottom can be opened and contents dropped into a dump truck. And away it goes.

. . . **Ainsworth-Precision Castings Co.,** Detroit, Mich., has reduced machining and surface preparation by die casting this three piece base plate for



a Friden type-composing machine. Side plate measures 7.5 in. high by 18.75 in. long and has as-cast straightness of 0.015 in. Note the large number of projections, recesses and holes accurately cast in position.

With Mogul you can see the difference!

For years, experienced foundrymen have looked to Mogul Cereal Binder to help them consistently turn out top-quality cores. First choice in cereal binders, Mogul gives perfect green bond, offers unusual dependability in spite of usual wide variations in mulling time, types of sand, core shapes and sizes. Mogul provides high green strength; cores hold their shape during handling and storage. They give good collapsibility and easy shake-out, cutting down on strains and hot tears. The excellent permeability of Mogul reduces costly blows due to inadequate venting.

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Circle No. 168, Page 21 or 79

HEALING HOT TEARS WITH VIBRATIONS

■ Although hot tears are a well-known nemesis of metalcasting practices, little consideration has been given to the possibilities of healing the tears. To heal cracks in certain alloys, vibration during solidification can be used. This treatment presumably helps molten metal run into incipient cracks. Results of experiments in this area of metalcasting technology were reported in Liteinoe Proizvodstvo, January 1958, and are summarized here.

To test the efficacy of vibration, a high-strength aluminum alloy was poured with a core which prevented shrinkage of the annular casting. Two rings were cast simultaneously with and without vibration treatment during solidification.

It was found that vibration during solidification reduced the hot tearing susceptibility. Hot tearing susceptibility decreases almost in direct proportion to the increase of vibration frequency.

Macroscopic and microscopic examination of rings cast with vibration showed small and large healed cracks, not observed in rings cast without vibration. The directionality and fineness of structure inside the healed crack are interesting. The microscopic revealed primary crystals of solid solution and the precipitated phase present. The healing metal had a composition frequently approximating that of the eutectic.

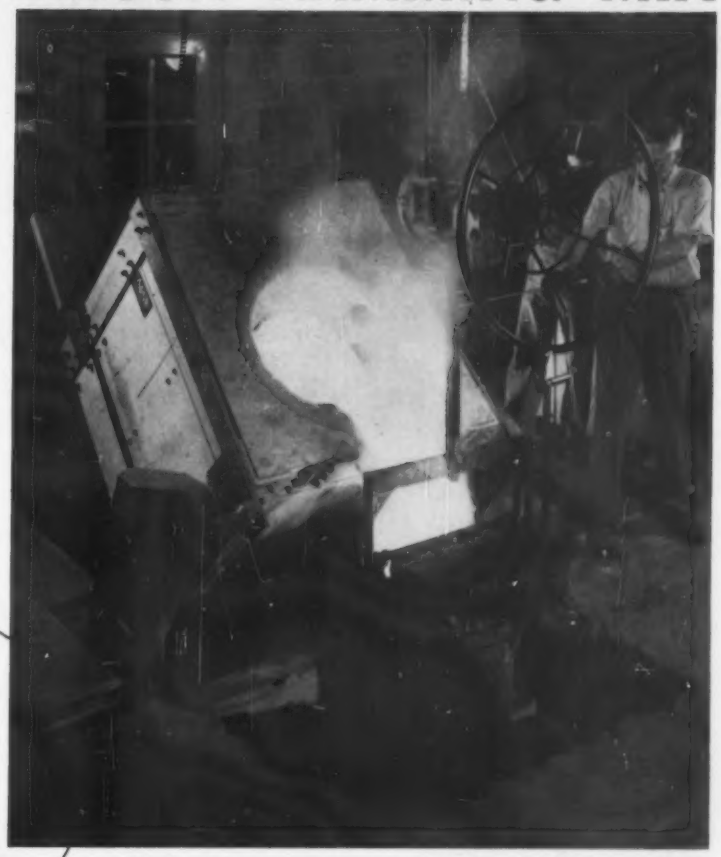
Hence vibration of a mold during solidification of a casting can be recommended as a method of welding hot tears. It should permit the use of high-strength alloys which, because of marked susceptibility to hot tearing, are either generally not used for permanent-mold casting or are used for a limited number of articles of simple shape. For eliminating hot tears in this manner an adequate reserve of liquid metal in the riser and proper feeding of the casting are very important.

A defect of vibrated castings is their surface roughness. Surface roughness can be completely eliminated by starting vibration after a fairly thick shell of metal has solidified. Vibration not only eliminates hot tears but also produces sounder castings with finer grain. A further attribute of the proceess is the remarkable capacity of filling complex intricate configurations in vibrated molds.

■ Condensed from a translation by H. Brutcher; circle No. 228, page 21, for a list of Brutcher Translations available for purchase.

WITH TAYLOR ZIRCON RAMMING MIX

Mould Manufacturer cuts induction furnace lining costs by 50%



Pouring a heat of grey iron from 650 lb. high frequency induction furnace lined with TAYLOR ZIRCON No. 717 Ramming Mix.

TAYLOR ZIRCON No. 717 Ramming Mix has cut refractory lining costs *in half* for a mid-west mould manufacturer. In addition, average number of heats has increased. This company melts grey iron in 650 lb. and 1000 lb. induction furnaces to produce moulds for the glass industry.

Alert foundries are standardizing on TAYLOR ZIRCON Ramming Mix as the most economical lining for high frequency furnaces. High softening point, low thermal conductivity, high di-electric strength, and volume stability make TAYLOR ZIRCON an excellent refractory for this service. For detailed information, write direct, or call in a Taylor field engineer.

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Circle No. 169, Page 21 or 79

Let's Get to the Bottom of it!

Carefully examine a Sterling — the tray, braces, wheel, legs, handles. You'll find it's engineered to take hard punishment for YEARS.

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Sterlings are so ruggedly constructed, they easily outlast any wheelbarrow on the market. Their long service life protects your initial investment...cuts depreciation to a minimum. Meanwhile, maintenance costs are nil. We invite comparisons. On the basis of total cost per year . . . *and that's the sensible way to figure wheelbarrow costs* . . . Sterlings cost less than any other barrow. Write today for catalog.

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Sterling WHEELBARROWS

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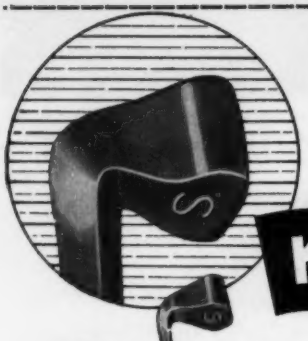


The KOOLHEAD 90°

The 90° bend under the head simplifies your operation and places the chill where it belongs. The "Koolhead 90°" will perform two duties: (1) a chill and (2) holding the sand on the surface of the mold. We feature clean, bright finished Horse Nails and can furnish the new bent head in any of the various "Koolhead" types.

Write for samples and prices.

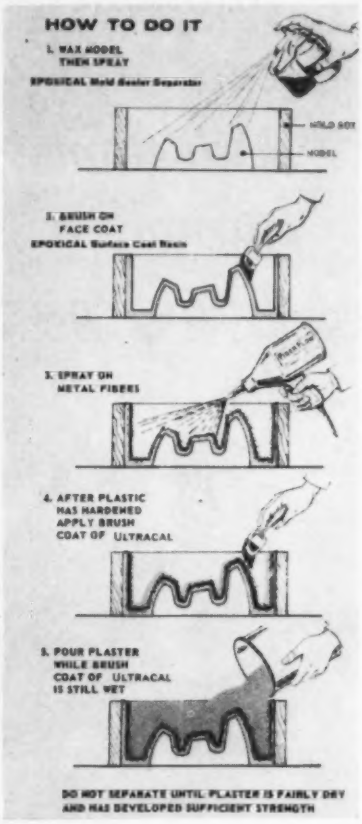
CHILL KOOLHEAD NAILS

STANDARD HORSE NAIL CORP
Since 1872 NEW BRIGHTON PA

Circle No. 171, Page 21 or 79

product report . . .

Plastic-faced plaster, a combination of high-strength gypsum cement with an epoxy resin surface, allows fabrication of jigs, fixtures, patterns and molds at 1/10 cost of epoxy laminates, according to U.S. Gypsum Co. Metal fibres serve as an interlock between plastic surface coat and plaster back-up materials. Metal fibres, 1/16-1/4 in. long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MODEL
2. BRUSH ON FACE COAT
EPOXICAL Surface Coat Resin
3. SPRAY ON METAL FIBERS
4. AFTER PLASTIC HAS HARDENED APPLY BRUSH COAT OF ULTRACAL
5. POUR PLASTER WHILE BRUSH COAT OF ULTRACAL IS STILL WET
DO NOT SEPARATE UNTIL PLASTER IS FAIRLY DRY AND HAS DEVELOPED SUFFICIENT STRENGTH

are applied by spray gun. Copper, steel and aluminum may be used but aluminum is recommended for its economy, stubby structure and ability to cling to vertical walls. Resultant metal fibre plastic facing is hard, tough, dense and durable.

For More Information, Circle No. 23, Page 21

No, I don't want a peanut and stop calling me Dumbo!

...where a little heat generates a lot of light! We're in Cambridge, Ohio, at VCA's modern Research Center and Pilot Plant. Here is where answers are found to all manner of questions about ferroalloys and their use.

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VANADIUM
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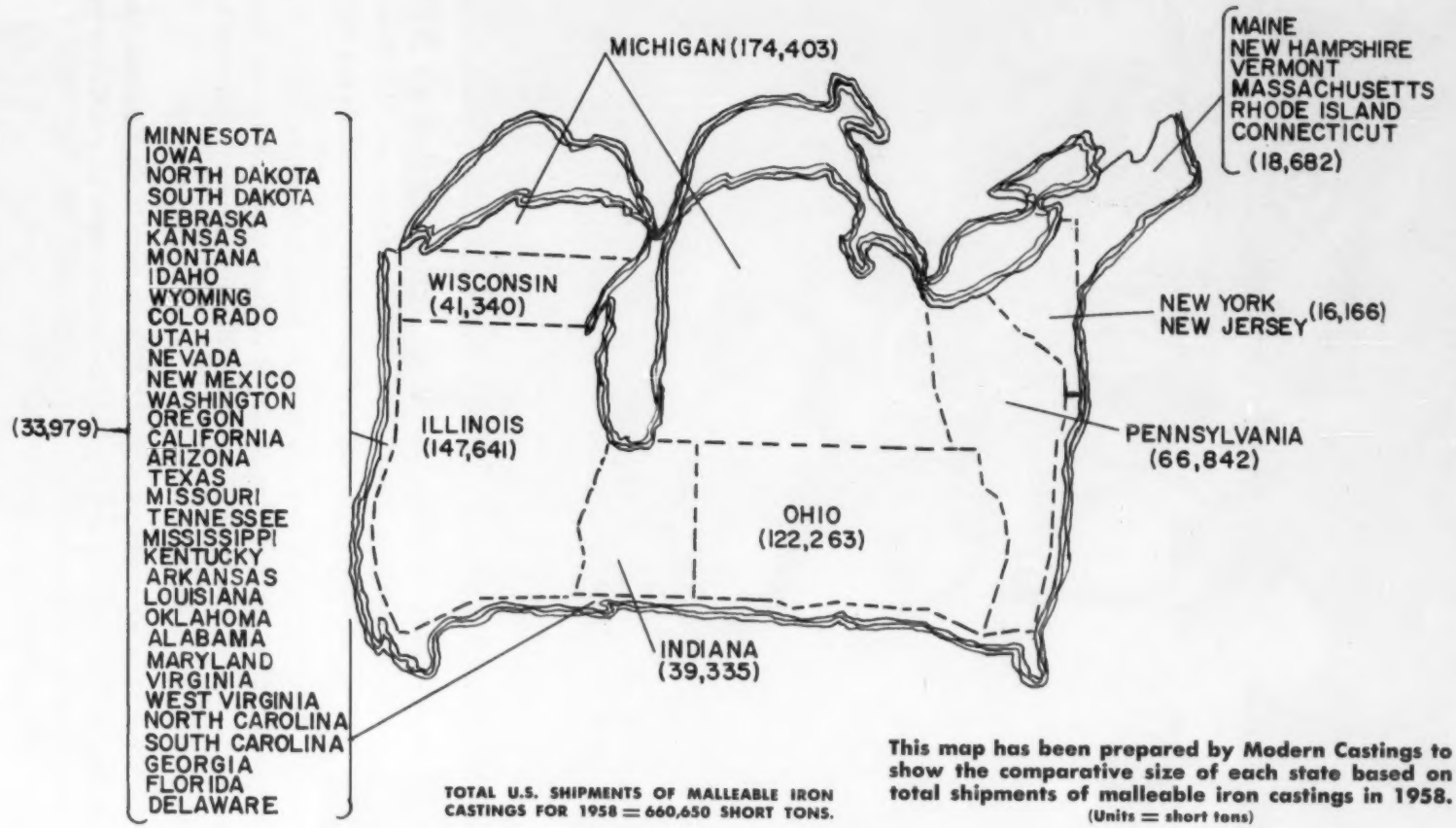
Producers of alloys, metals and chemicals

Circle No. 172, Page 21 or 79

How the United States Looks to the . . . . .

MALLEABLE IRON CASTING INDUSTRY



TOTAL U.S. SHIPMENTS OF MALLEABLE IRON CASTINGS FOR 1958 = 660,650 SHORT TONS.

This map has been prepared by Modern Castings to show the comparative size of each state based on total shipments of malleable iron castings in 1958.
(Units = short tons)

the editor's report

by Jack Salamon

■ **Is CO_2 necessary** . . . evidently not. According to W. G. Probst, C. Lee Cook Co., Louisville, Ky., it's not always necessary to gas your sodium silicate bonded sand with CO_2. The satin finish on these two gray iron castings is

representative of the kind of detail and surface quality that the Cook foundry gets by facing green sand molds with their regular CO_2 sand mix. But . . . the facing is not gassed . . . just close the mold and pour .

■ **The Christmas holiday season** is a traditional time for giving. One of the finest examples of **Corporate giving** in the foundry industry has been inaugurated by Beardsley & Piper Div., Pettibone Mulliken Corp. For the third year now they have **donated two university engineering student scholarships** to be administered by the Foundry Educational Foundation. This far-reaching and long-lasting gesture has replaced the former practice of sending small individual remembrances to their many customers. This kind of giving has many admirable facets. It helps young men to get a college education; it gives them basic training in metalcasting technology; it contributes to the future success of the foundry industry; and every customer feels a little better deep down inside because the gift he did not receive made this possible.

■ **New pattern making technique** . . . is creating quite a stir in the industry. Patented process uses a metal carbonyl vapor from which an alloy metal coating can be deposited on a master pattern. Thin layer of deposited metal has a hard smooth exterior finish with good erosion and corrosion resistance needed for heavy duty molding service. Strength and rigidity are supplied by plastic or metal back-up material.

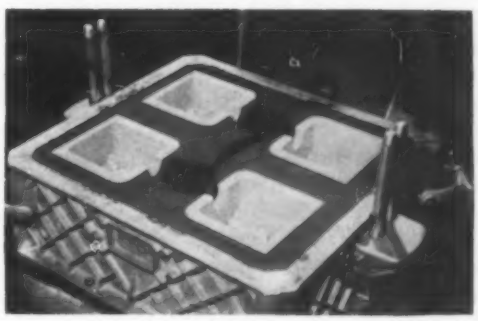
■ **Green sand—resin shell mold combination** . . . demonstrates metal casting ingenuity that takes advantage of both processes. Pictured here is a green sand mold in which casting cavities are "faced" with shell molds. Gating system is cut in green sand which also serves as backing to resist metal pressure and locate cope and drag shell halves. Earl Jahn, Production Foundry & Pattern Co., provided Modern Castings with this excellent example of green sand and shell molding working together.

■ **102,000 reprints** . . . of 56 different Modern Castings feature articles have been purchased during the year 1959 for further widespread distribution throughout the metalcasting industry. This record-breaking demand for supplemental copies is dramatic testimony of the technological awakening of that sleeping giant — the foundry industry.

■ **Chills can be integrally molded** in position in shell molds and cores by holding them in position with permanent magnets while mold is being made or core is blown around them.

■ **Low-cost iron desulphurizer** . . . was described by F. C. Barbour, Republic Steel Corp., in a recent talk at the New England Regional Foundry Conference. Here's how it works. Dense soda ash or a mixture of it and calcium carbide is stored in hopper located near cupola and above tuyeres. Material feeds from hopper into tube or pipe projecting horizontally into one of the tuyeres. Compressed air injects the desulphurizer into cupola reducing content to as low as 0.025 per cent in an acid operation. Equipment can be built and installed for as little as $20.

■ **Stop molten metal erosion** . . . at bottom of down-sprue by placing a metal plate at this Achilles' heel of gating systems.



by BRUCE L. SIMPSON,
President
National Engineering Co.
Chicago

your foundry cannot survive

. . . you develop Administrative Management

THE NUMBER ONE TASK of any company president, regardless of his age and condition of health, should be a constant and continuous effort to find a substitute for himself. There has been for time without end a feeling on the part of many presidents that the selection and grooming of his own replacement will take care of itself . . . that somewhere out of the blue will come the man who will permit him to relax on a beach in Florida supported by the newer man's energy and industry. This "pipe-dream" thinking by presidents, more than any other factor, is probably the major cause of losing staff personnel.

A younger man, capable of handling the job, simply will not wait. Therefore the up-stream-thinking president will preserve his company by filling his staff with potential presidents. Only one, of course, will get the top job, but there should be several to allow for mortality of various types. When a president selects his top administrative people he should ask himself "Can this man run our company some day?" And he should see to it that the men in this group realize they are being considered for the presidency and understand all the steps necessary to develop top-caliber people.

■ **What kind of men should be considered as executive candidates?**

1 They should be 20 to 25 years younger than the existing president. A man the same age as the incumbent president is very difficult to satisfy. He is discouraged from the start because he knows that if he gets the top job it probably won't be for a long period.

2 Candidates, regardless of technical or sales ability, should have, above all other skills, that indefinable attribute called "leadership." Unless they can convince without force, titles won't do it.

3 Tomorrow's leaders must have imagination and to some extent a disregard for precedent. All companies grow just like people. What is gospel as policy today may be a complete drag on the concern in the next decade.

Continued top of page 38

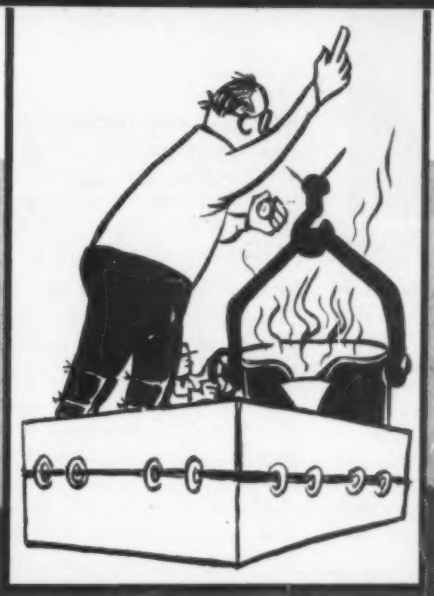
. . . you develop

The technical needs of a business may be roughly divided into outside technical assistance and technical needs within the company itself. The available outside sources of technical assistance include the following: commercial testing laboratories, consulting firm or individuals, consulting laboratories, college institutions, independent research institutions and foundations, trade publications, professional societies, technical libraries and the patent office.

The technical jobs to be filled within a company range from routine technician jobs for chemists, draftsmen, etc., up through top managers making major decisions. Most of the technician jobs around a foundry can be adequately filled by those having high school level of education or even less. But they could be utilized better in many instances as a training ground for persons destined to move up the management ladder.

What kind of people and how many are needed in technical jobs? How are they attracted to the castings industry? How are they developed once they are there?

by JOHN H. CULLING
Vice President
Carondelet Foundry Co.
St. Louis



by L. J. WOEHLKE
Works Manager
Grede Foundries, Inc.
Milwaukee

unless...

Technical Personnel

. . . you develop Operating Supervisors

■ **What are the requirements today for developing technical personnel?** Certainly there is the matter of training, or learning to do, if drafting, metallography and similar skills are concerned. But in my view, education, or the learning to know, is of far greater importance in the higher echelons of management. Today the person who has formal education and training in his field has a great advantage over the person who does not. Even more specifically, the precious little time allocated to formal education should be devoted mostly to basic or fundamental principles in preference to very specific or vocational studies. The information learned in schooling is of far less value than are the attitudes of interest, curiosity, perseverance and willingness to accept change.

Technical development, like any other management development, must be a never ending process in a well run business enterprise. The foremost principle of management development must be the concept of development of all members of theh management group. Those

Continued middle next page

Technically trained people are taking over the "art" in foundries by specializing in the control of many phases of metalcasting operations previously the responsibility of old line operating supervisors. Molding foremen formerly controlled sand properties by sand "feel." He made on-the-spot adjustments in additives to get that desired "feel."

Today, operating men and technicians work together to establish sand requirements. Standards and controls are set up by technicians to suit the people. Then it becomes the responsibility of operating supervisors to direct and police the controls. This same sort of procedure is taking place in other phases of foundry operations. Metallurgists become involved in establishing melting procedures as well as metallographic, x-ray, magnaflux and other inspection procedures.

■ **Mechanical molding and coremaking methods have transferred other foundry arts from molders and supervisors to engineers and technicians.** Pattern equipment for use on these machines is designed to include gating and risering instead of being left to the judgment of the molder or his foreman. As mechanization increases we can expect to see more mechanics and fewer molders and coremakers.

It follows that our operating supervisors will need more mechanical background to supervise their men and machines. Foundrymen in the past concerned themselves with all phases of the casting process and its inherent art. Tomorrow's foundrymen will probably be a staff technician—a complete reversal of the situation when the technicians and engineers entered the foundry industry. This transition is taking place in varying degrees at the present time. The amount of change for each company depends on the extent of mechanization and degree of control required for the types of castings and metal produced. Therefore, there is no completely satisfactory universal industry-wide system for "Developing Operating Supervisory Personnel".

Grede Foundries, Inc. have a formal supervisors' training program. However, the company takes

Continued bottom next page

SIMPSON – *Continued*

4 They must be acquisitive and aggressive . . . that is, lean and hungry. Not necessarily for money, but aggressive for authority and what they call in the army "desire for command decision."

5 The most successful executives are lone wolves. They do not necessarily fit in as organization people, because for the most part they are individualists.

So you see that the top staff of such a progressive company would not be a particularly pleasant place if filled with potential executives of this type. The fallacy of most executive thinking is to surround the head man with fawning "yes" men who create an atmosphere of cordiality. But this places a dead hand on progressive action for the future of the concern and its stockholders.

■ **Now let's look at the average foundry development and the growth of a foundry enterprise.**

The classic example of a foundry concern usually goes something like this. The developer of a new company usually works at first for someone else. He is usually highly skilled technically; but he also has that burning desire to be his own boss.

Let's assume his name is Joe and that he is a molder, a good one—not just on a machine but almost an artist with sand. Day after day Joe works for wages, but knows he can do a better job on his own.

Finally, in one way or another, Joe meets a customer and shows him how he could do a better job cheaper if he could work direct. In one way or another Joe finally convinces the potential customer and perhaps even borrows the money from him to start in business. At that point a company is born.

But also at that point a President or a Boss or a Simon Legree is made. This is private enterprise and he is a private entrepreneur. This type of president is, and always will remain, a one-man show. There are 3000 foundries in the U.S.A. now in this category.

Let us assume that our rugged individualist is a success. Besides the necessary technical skill he has the ability to set a fair price, hire good people and operate his business with conscience. He is interested in technical improvement.

CULLING – *Continued*

members of the group who need the developing most are those who are not poor enough to be discharged but not good enough to be promoted.

■ **The second principle of management development is that it must grow and change.** It should never be directed toward replacements of today's managing people, their responsibilities or their qualifications, as such. It should build for future needs. It should aim at development of whatever type of organization and managers will be needed to attain the objectives of the long range plans of the business. Mere replacement of today's managers means stagnation.

One of the greatest impediments to the development of a young manager is self-imposed; it is his inability to see beyond the "organization chart" of today. He works toward the day when he can step into the shoes of one of today's managers. He fails to realize that development must be self-development.

Although top management has the opportunity to encourage or to kill individual self-development, it cannot be responsible for that development. Only the individual can assume the responsibility.

Managers are successfully developed in the same manner as they are successfully promoted. They are not suddenly thrust into a most important position. They are given smaller tasks at first. If they perform well, they are advanced on the basis of performance, not upon hunch or favoritism. No man should ever be given made work, but every man can be challenged by changes in the scope of his work. The top managers of the future are the junior managers of today.

As Peter F. Drucker so aptly stated in "The Practice of Management," the prime motive of the businessman is not the maximization of profits—it is the avoidance of loss. The first duty of a business is to survive. The only valid definition of business purpose is to create a customer. Obviously the custom-

WOEHLKE – *Continued*

advantage of courses sponsored by universities, colleges, technical and non-technical societies and associations. Our plant managers have informal dinner meetings with their supervisors. Also the seven-plant supervisors' meet at dinner with wives in attendance at least annually and at any other time that a pertinent subject requires it.

Supervisors are selected from both plant personnel and college graduate trainees. A firm of consulting psychologists surveys our plant personnel to earmark people as future candidates for supervision. The majority of supervisors have been promoted from within the Grede organization.

■ **The college graduate training program is a working training program.** The trainees work on production jobs in all departments in several if not all of our plants. Trainees are moved through the various departments with consideration given to both personal skills

Aside from his native canniness with money, he also has a burning curiosity for development and improvement. This new president is one man in a million and basically he is what makes America tick. Some of you may be in companies like this with the original driving force still in command.

■ **Most of you are probably in concerns passing through the consolidation stage.**

In this period a pattern of procedure has developed which calls for administration of a different nature. Now an executive must understand legal matters, labor situations, taxation problems, competition, satisfaction of nonstaff employees, systems of financial and administrative control and the satisfaction of an intelligent and diversified Board of Directors. However, whether the company is simple or complex, the progress and profit of the company will correspond with the length of the shadow of its chief executive.

The chief executive has typically two types of assistants. They are known as staff and line executives. Staff officials can be considered assistants that have to do with executive planning. They include legal and tax specialists, research and product analysts, together with engineers and advisers not usually involved in every day problems.

Line officials usually include men who have to do with day to day operations. This would include vice presidents in charge of sales, production, personnel and finance. These may or may not be involved in staff procedures. But generally line officers sell, produce and finance current products.

From the president and his assistants should come new products, new plants and production methods, and top level research and financing ideas for expansion of the company's interests. Therefore the president should be considered the future of the company—five or ten years in the future. He must make the company grow and develop or it will soon cease growing and will wither and die.

Why anyone wants the responsibilities, worry, thanklessness and general cussedness that go along with being president is almost beyond understanding. But those of you who want to be president badly enough, almost certainly will achieve it, as that factor alone seems to be the controlling influence.

Good bosses are almost certainly born and not made.

er determines what a business is through his wants and dislikes, his concept of "value" in a product or service and his choices of what he will purchase. New customers are created by the business action of advertising, salesmanship or the invention of something new.

Therefore the only two basic entrepreneurial functions of any business enterprise are marketing and innovation. Profit is the result of or the measure of business performance in productivity, marketing and innovation.

The proper balance of all production factors that accomplish the greatest output for the least effort means the highest productivity. Marketing is the important and unique function of a business organization that distinguishes it from other types of organization.

But marketing and productivity alone are not all that is required for a continued successful business enterprise. A business must do more than provide goods and services; it must provide superior and more economic goods and services. A business need not grow bigger, but it certainly must constantly grow better.

Every unit of management should have certain innovation goals. Innovation leadership can generally be centered in one functional activity in a business, particularly one which stresses engineering or chemistry. This functional activity is a part of the technical phase of management.

While innovation may be in the form of a new or better product, it might likewise be in the form of lower prices. One might consider innovation in products or services on one hand and innovation in the skills and activities required to supply them on the other. Innovations may be of technological or of economic nature.

Innovation is the most important function in the technical phase of management. But there are other technical functions of vital importance of a business enterprise. One can easily recognize the importance to the castings industry of engineering, or the art or science of making practical application of the knowledge of pure sciences such as physics, chemistry, metallurgy, etc. And all engineering is certainly not innovational engineering. Scientific knowledge has many practical applications such as routine flow and handling of materials, the fabricating, forming, shaping or treating of products, and control of products or processes.

and the plant production schedule. Time spent on various operations will vary from plant to plant but the overall result will be a working knowledge of the fundamentals of most operations.

Theoretically, the time required for this training course is two years. However, the average is less than one year since the trainee usually shows definite interest and ability in a particular phase of our operation before the end of the first year and is assigned accordingly. The college graduate training program provides background for operating personnel from foreman to vice-president. The company feels that the program has been successful because it provides first hand working knowledge to complement formal education.

Grede Foundries program of upgrading plant personnel improves employee morale and makes available the kind of practical experience which cannot be acquired from a formal education. The combination of both programs is necessary for training operating personnel to meet the competitive challenge of our industry.

The technical problems involved in operating a foundry grow more complicated every year. This trend makes it imperative to fill operating positions in our industry with men having engineering or technical background and training.

countdown on

If you design, build, purchase or use patterns for shell molds or core boxes for shell cores, then you should read and save for handy reference this CHECK LIST as a guide to future planning.

For Shell Core Box Equipment

15. Round all outside corners on core boxes.
Increases life of asbestos type gloves usually worn by operator. Helps other handling such as setting up, box rotation for core drainage, propelling box to and from oven, etc.

14. Pattern number and company name should be stamped on each end of core boxes.
Facilitates identification of core boxes in storage.

13. Stamp each core on one core print area with pattern number. (This requires use of left hand pattern numbers.)
Facilitates identification of cores in storage.

12. Blow plates should be relieved around blow hole area to restrict surface contact with core box.
Minimizes heat transfer from core box to blow plate. Prevents semi-curing of coated sand in blow head.

11. Use 1/4-in. steel on shell core box faces.
Insures return of original dimension when replacement due to wear is necessary; also enables countersinking fastening screws. This thickness prevents steel from warping.

10. Clean rubber and metal with gasoline before applying rubber to blow plates.
Prepares surfaces so they won't separate in operation.

9. Push out pins on ejector plates to be made of 3/8-in. C.R.S. with brass tips.
Brass tips prevent surface wear on core box if misaligned.

8. When constructing push-out type core box, core diameter should be stamped on hinged plate end of core i.e., No. 20 designates 20/32-in. or 5/8-in. diameter core; No. 27 designates 27/32-in. diameter core.
Facilitates core identification in storage as well as potential use of diameters in several different castings.

7. Bottom plates should be bolted on one half of split type core boxes.
Facilitates box alignment prior to engagement of locating pins.

6. Ejector pins should be brazed or threaded on shell core box ejector plate.
Withstands expansion and contraction encountered in core box cycling.

5. Hinged plate on push-out type core box should extend at least 1 in. beyond ends of box.
Facilitates handling by operator.

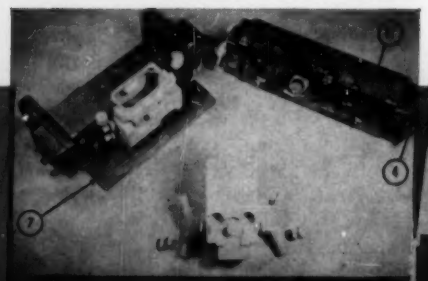
4. Make all split core boxes 13 in. long.
This practice allows all boxes to be used without adjusting opening fixture.

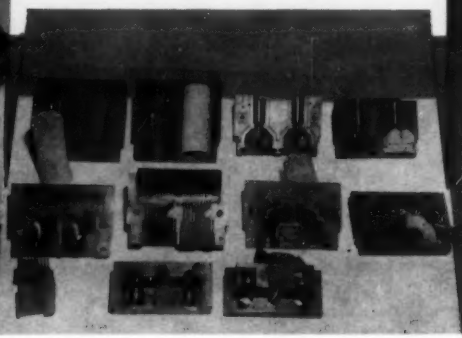
3. Hangers for push-out cores should *not* have set screws.
Hangers break at this point.

2. More time should be spent on shell master pattern equipment in regards to a smooth finish, fillets, etc.
Roughness in fillets and finish will cause sticking. Stripping of a pattern in this condition can be a problem. A smoother mold will result in a smoother casting.

1. Core clearance is a must on shell master pattern core boxes and pattern equipment.
Slight contraction in mold cavity makes core clearance a necessity.

Numerals refer to construction hints outlined in the text above. Center photo demonstrates hints No. 1 and 2.





construction hints

by EARL W. JAHN
President
Production Pattern & Foundry Co.
Chicopee, Mass.

For Shell Pattern Equipment

13. Round all corners on gates and patterns.
Facilitates stripping of shell from the pattern. Prevents mold cracking. Eliminates loose sand which remains on pattern when sharp corners have been used.

12. Cut holes through plates under all mounted patterns and risers.
Permits maximum heat transfer so even pattern temperatures persist throughout the impressions, plates, risers, gating, etc.

11. Minimum of two ejector pins should be placed close to down sprue.
Helps in stripping shell from sprue. Otherwise sticking would occur on vertical surfaces due to inherent lower temperatures which exist on the highest pattern projection.

10. Ejector bushings should be anchored to the pattern plate.
Bushings must be press fit and peened from plate face. This prevents loosening of bushings due to oxidation as well as heating and cooling cycles. Or tack weld bushings to plate to prevent bushing from coming loose.

9. Use ejector pin weights instead of ejector springs.
Stainless steel springs, formerly used, became useless when they lost tension due to concentrated heat. Use of weights also increases life of ejector pins by reducing concentration of high temperature at lower end of pins.

8. Place sprue as near center of plate as possible.
When molten metal enters sprue, thermal shock takes place immediately. Sprues placed near ends of the mold have greater tendency to mold cracking from uneven mold expansion.

7. Use maximum 3-in. sprue when pattern does not project in cope.
More than 3-in. height creates excessive mold pressures thereby distorting dimensional stability of castings. Lower mold yield also results.

6. Use flush ejector pins on small holes that could result in a shell mold sticker.
Assures operator of ejection in the hole. Then he won't have to dig out a broken shell.

5. Use strip vents 1/4 in. x 1/4 in. minimum; pin vents where necessary and carry to edge of mold.
Permits immediate escape of gas generated when mold is poured. Excellent in shell molds made from finer sand grains. Strip vents enable proper fastening to pattern plates and provide sufficient passage for gas even if bonding resin has dropped into vent area.

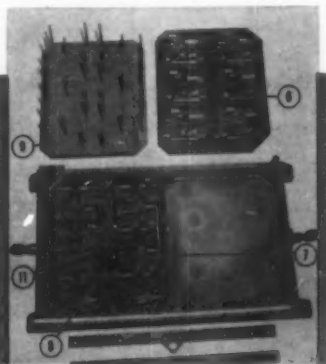
4. Don't use aluminum on iron patterns or core boxes.
Too great a variation of coefficient of expansion between metals. Aluminum, basically a soft porous metal, is prone to scuffing and skiving on vertical surfaces thereby reducing the life of pattern equipment, finish of castings and loss of dimensional stability. Aluminum patterns and core boxes are severely attacked if cleaned with a caustic base solution.

3. All pattern equipment should be properly identified with customers name, pattern number and foundry symbol.
Place all marks on castings where designated on casting drawings. Customers name and pattern number must also appear on end of pattern plate to facilitate location and withdrawal from pattern storage racks. All core prints are to be stamped with "CORE" to signify core requirements.

2. Stamp runner for identification of metal to be poured, "25" for 25,000 psi and "35" for 35,000 psi, etc.
This institutes an immediate positive control for location and storage of return gating systems for use in future cupola charging.

1. Peen all gates and runners at joints for a tight fit.
Surface to surface contact of runner to end gate and end gate to pattern must be complete. This will prevent loss of castings due to sand-resin mix entering junction, causing fin and washing into casting cavity.

Numerals on pictures point out the construction hints for patterns enumerated in the discussion above.



DEXTROSE scores knockout in CO_2 process

After switching to the CO_2 process of coremaking, Pohlman Foundry Co., Buffalo, N. Y., a gray iron jobbing foundry, soon discovered collapsibility of cores could be improved as much as 50 per cent by adding dextrose, a pure corn sugar, to its core mix. Not only is knockout easier now but better peel and casting finish are obtained.

by DANIEL R. POHLMAN,
Vice-President
Pohlman Foundry Co.
Buffalo, N. Y.

Improved collapsibility of cores and easier knockout resulted from adding dextrose to Pohlman Foundry's sand mix for coremaking by the CO_2 process.

Before adding dextrose to the sand mix for CO_2 process coremaking, core removal from castings was exceedingly difficult and often impossible. By adding 1.5 per cent of dextrose to its core sand mix, Pohlman Foundry can now produce cores that are 50 per cent better in collapsibility. Even in the smallest castings, cores containing the dextrose knock out easily.

Besides improving collapsibility, dextrose additions led to better peel and higher quality surface finish. Since sand cores made with dextrose have less tendency to burn onto the casting, peel or separation of metal from sand is greatly improved. Dextrose breaks down or decomposes at temperatures far lower than the pouring temperature of hot iron. And because it produces an inert atmosphere of carbon dioxide, it helps to safeguard against surface defects in finished castings.

Another advantage attributable to dextrose is the ability to keep the mix for several days before using. Moreover, the new mix is the least costly that we have ever used. The new mix is 20 per cent cheaper than our former core sand.

Casting Production

Celebrating its fiftieth anniversary this year, the Pohlman Foundry, with about 110 employees, is a jobbing foundry producing gray iron castings for manufacturers of heavy machinery and for the machine tool industry. Plant capacity is 25 tons of castings per day.

The castings produced here require cores and molds of the greatest dimensional accuracy and freedom from surface defects. These castings include pump and blower housings, diaphragms for steam turbines and such meat processing machines as grinders, stuffers and chopper bowls. Pohlman also turns out parts for can-making machinery, diesel engine parts and a considerable volume of tool and die work.

Castings range in weight from a few ounces up to about four tons. A single casting may be as small as an egg or as much as seven or eight feet square. Steam turbine diaphragms are the most intricate castings produced and call for extremely close tolerances.

In the summer of 1956, Emil A. Piper, chief engineer for Pohlman, participated in an international conference in Europe. While there, he visited foundries in England, Holland and Germany, seeing firsthand how they had switched to the CO_2 process for molding and core making.

Partly as a result, Pohlman Foundry began three years ago to replace dry sand molding by the CO_2 process. The switch to CO_2 for molding was made to speed up production and to provide an easier molding method calling for more science and less art than dry sand molding.

Then the foundry began switching to the CO_2 process in the coreroom. And finally they began adding dextrose to core mix for improved collapsibility.

Rapid hardening of cores achieved by blowing CO_2 gas through side of corebox; gas reacts with sodium silicate binder to harden core.

Within few minutes, core box can be stripped off the hardened core, and core is ready for use in the foundry.

Advantages

The CO_2 process is most effective for production and rush jobs. Cores are immediately ready for use after ramming, gassing and finishing. No waiting for cores to bake and cool. Accidental damage to cores during handling has been reduced. Fuel expenses for baking have been eliminated.

Veining and scabbing on the interior surfaces of finished castings, which result from expansion defects of the cores, have been largely eliminated by the use of CO_2 cores containing dextrose.

Greater dimensional accuracy can be more readily attained in cores made by the CO_2 process. The CO_2 process has eliminated expansion problems that occurred during baking and distortions resulting from handling.

Sand Mixing

In the mix for coremaking, new sand is used exclusively. Sand arrives at the Buffalo foundry by railroad car and is unloaded by a conveyor placed under the car. This conveyor moves the sand into one of five bins, each with a 50-ton carload capacity.

The CO_2 sand used is a washed and dried sand with an average fineness of AFS 75 obtained by blending a No. 105 and a No. 50 silica sand. Moisture content of the mix is critical and must not exceed 1.6 per cent. The dextrose used is of such a fineness that it is readily dispersed throughout any sands normally used.

In preparing a 1,000-lb core mix for the CO_2 process, sand and dextrose are first blended dry; then the sodium silicate is added; and finally the individual grains are coated with sodium silicate film by wet mulling. The mulling cycle is:

1 min.—dry (sand and dextrose)
3 min.—wet (sodium silicate added)

The CO_2 core mix made with dextrose is now fully as flowable as a conventional sand mix. After mulling, the mix travels to the coreroom in three-wheeled buggies. Plastic sheeting covers the mix while it is being moved and stored as a safeguard from air drying.

Core making

Jolt-rollover, blower and hand ramming methods are all used by Pohlman for making cores. When the sand is compacted in the coremaking process these coated sand grains are brought much closer together, with the thin film of sodium silicate binder still between them.

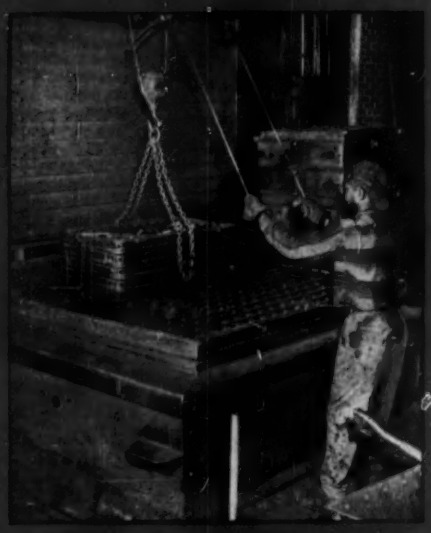
After cores have been made, they are hardened by blowing CO_2 through the core box. A hose with a rubber nozzle introduces the CO_2 into the side or bottom of the core box. Dry ice converters generate the carbon dioxide. The CO_2 gas travels throughout the shop to the various molding and coremaking stations in pipes at 40 psi pressure.

Core hardening results from a chemical reaction between the CO_2 and the sodium silicate binder. The gelling action of the acidic CO_2 gas rapidly converts the silicate into a strong silica gel which binds the grains together forming a hard core.

To prevent hot metal penetration into the sand, cores are sprayed or brushed. On large cores, a zir-

Can the metalcasting industry meet the rigid needs of today's vast

After curing, core is set in the mold. CO_2 process has reduced the floor space needed for coremaking.



Shakeout has been much easier since adding dextrose to sand.

D. Pohlman, vice-president, and W. Knoll inspect finished casting.

conite wash is used, followed by a graphite wash. Small cores get a graphite wash with an alcohol base (usually isoprypyl alcohol). This light-off wash can be readily burned off, or air dried.

Previously a water base wash was used. If the cores were not hot enough to dry off or evaporate the wash, they went back into the oven for additional drying or were skin dried by torching.

Finished cores are transported on skids by fork-lift truck to the foundry. Sometimes, on rush orders, the core boxes are taken directly to the molder. He lifts out the cores, uses the alcohol base spray, lights off, lets the cores cool a few minutes, sprays them again and sets them in the mold. Molds are now ready to receive molten metal.

Metal Pouring

A monorail transports the ladle of hot iron to the molding stations, where it is poured at 2700-2800 F. In the small mold department at Pohlman, foundrymen pour hot metal from ladles holding 500 to 1000 lb. In the large mold department, hot metal is poured from ladles holding 1000 to 2000 lb.

The dextrose, an organic additive, begins to decompose at 350 F and is completely decomposed long before reaching 600 F. Heat from the freshly poured metal in the mold therefore causes the dextrose to decompose. The resulting carbon dioxide helps to maintain an inert atmosphere which improves sand peel and surface finish of castings.

Core collapsibility is improved because the dextrose decomposes or burns out when subjected to heat from the hot metal during casting. Bonding between the sand grains breaks down and cores collapse easily. Without dextrose it was difficult or even impossible to remove cores from castings.

Shakeout

The mold shakeout operation takes only a few minutes on a vibrating shakeout grate. These vibrations loosen the sand from flasks and castings so it falls through the grating and goes to a sand storage hopper for re-use.

While small castings are lifted off the grating to prevent damage, larger castings can safely withstand vibrating on the grate to free them of sand. The grating is inclined slightly so that the castings slide off. Next, the operator knocks off gates and risers with a hammer.

After cores are knocked out, the castings are taken to the cleaning room for sand blasting, cleaning and chipping to remove traces of risers, gates and fins. Finished castings are carefully inspected before shipment.

At Pohlman Foundry supervisory personnel pride themselves on maintaining good housekeeping throughout the plant. All windows are washed regularly and the plant painted periodically by the foundry workers themselves. The employees also take pride in keeping the foundry clean.

Teamwork and loyalty are characteristic of the employees at Pohlman Foundry. The company has an interesting and rewarding incentive plan for its employees, many of whom are highly skilled veterans with long experience. ■ ■ ■

■ Can the metalcasting industry meet the rigid needs of today's vast aerospace complex? Apparently not . . . in the opinion of Y. J. Elizondo, Chance-Vought Aircraft Co., Dallas, Texas. In an article entitled, "Steel Castings for the Aircraft Industry . . . Quality Requirements," June issue, *Modern Castings*, Mr. Elizondo pointed out the shortcomings of foundrymen in failure to meet aircraft requirements for strength at elevated temperature . . . reproducibility . . . inspection criteria . . . and promised delivery dates. *Modern Castings* presents here a defense of the metalcasting industry. John H. Rassenfoss, American Steel Foundries, East Chicago, Ind., gives the foundryman's viewpoint in the following comments . . . which are, in turn, replied to by Mr. Elizondo.

FOUNDRYMEN versus AERO-ENGINEERS

by J. A. RASSENFOSS
American Steel Foundries
East Chicago, Ind.

and Y. J. ELIZONDO
Chance-Vought Aircraft Co.
Dallas, Texas

Comments by J. A. Rassenfoss: The manufacture of steel castings for aircraft is an important subject and it is gratifying that Mr. Elizondo has brought the subject to the attention of the foundry industry by writing this particular paper and presenting it at the 63d AFS Castings Congress. Steel castings have evidently presented both possibilities and problems to the aircraft industry. Apparently the problems now greatly outrank all other factors with the result that the promise of steel castings is not being fulfilled. Like most problems, there are two sides to this one.

The author states that the foundry industry has not provided a set of "uniform and rigid specifications to govern the production of aircraft castings." It is true that the steel foundry industry has not produced a specific specification for aircraft castings. The industry has long desired to reduce the number of specification writing bodies and specifications to a minimum. To that end increasing emphasis has been given to the placement of this activity within the framework of the American Society for Testing Materials. Although there is no specification now in the A.S.T.M. that covers the future requirements of the aircraft industry, the present specifications offer the opportunity for it to be done rather simply.

So the aircraft producers and the actual as well as potential aircraft parts suppliers should get together within the A.S.T.M. organization and develop materials purchase specifications which are suitable to both parties. This would enable full use of present information and the addition of any new materials desired by the aircraft industry.

Mention is made of the inability of foundries with

Continued top of next page

Response by Y. J. Elizondo: Yes, there are two sides to every problem and it was with the purpose of presenting the aircraft side to the foundry industry that my paper was prepared.

So long as a part produced under a given specification does not function satisfactorily for the design purpose intended, the specification is inadequate regardless of whether the problem is low strength, lack of uniformity, etc. This has been the case for a large number of the aircraft castings produced to date. The suggestion that the specification writing be consolidated to a single group or activity is a step in the right direction. But, equally important will be recognition that there are many widely different design requirements, design philosophies and environmental requirements which will require various specifications in order to meet the casting user's needs in the most economical manner.

It was not intended to imply that the foundries with whom our company has dealt have been unable to control the mechanical properties of the test bars. On the contrary, the uniformity of the test bar results has been quite good; it is the inability to reproduce these same properties in production castings with the same or even similar uniformity that is the source of trouble. Chance-Vought has made a maximum effort to seek out qualified foundries with no significant change in performance noted. If, as stated by Mr. Rassenfoss, steel castings with guaranteed properties in the castings of the levels indicated were produced, I am sure they would find a receptive market in the aircraft industry.

As for delivery schedules, or rather lack of them,

Continued bottom of next page

RASSENFOSS, *continued*

whom the author is dealing to supply test bars which give consistent results. We regret as much as the author that these foundries were unable to do a satisfactory job. However, we cannot accept the statement that this is a proof that all units of the industry are incapable of controlling mechanical properties of steel. In the steel castings industry, as in all others, there is a wide diversity of ability when all of the members of industry are considered. Therefore, it behooves those who seek particular qualities in purchased material to find those business concerns which are most capable of doing a job best.

If the aircraft industry seeks a satisfactory experience with castings and desires to obtain the many benefits which they offer, then they must seek out those foundries which have the necessary qualifications for the difficult work required.

Some steel foundries can obtain satisfactory strength control of cast steel, at high strength levels. For instance, American Steel Foundries has marketed for several years a high strength cast steel at the level of 225,000-250,000 psi ultimate tensile strength. We consistently manufacture this material in quantity, controlling the hardness and impact characteristics within the tolerances which the aircraft industry apparently desires . . . and there are other foundries which can do as well.

Mr. Elizondo mentions considerable difficulty in obtaining castings according to the deliveries promised by the foundries involved. The ability to deliver on time varies considerably from one company to another whether it is the foundry industry or some other.

The aircraft industry has a reputation for constantly seeking higher performance and for that reason consistently changes the design of the part and the material requirements. This progressive attitude is indeed commendable; however, the constantly changing requirements makes it difficult for any materials supplier to advance his practices to keep up with the changing goals while maintaining a tight schedule.

Foundrymen quoting on a part having a new design and a brand new materials requirement find it difficult to accurately state delivery dates. Perhaps both parties in this case have been guilty of assuming that this is strictly a production problem. In reality, it is a development problem. Meeting a deadline for solving a development problem is considerably more difficult than meeting a schedule for producing an item of established design and material.

The aircraft industry is seeking the best product that the industry can produce and is constantly raising strength-weight ratio goals. The aircraft industry seeks not only high quality of production, but also a continuous development program. To meet these needs, qualified foundries must have the following attributes:

1) A technical staff of high quality with good depth.
2) Excellent laboratory and pilot plant level equipment to carry out the necessary experimentation and analysis to solve problems such as are created by the new demands.
3) A trained and disciplined manufacturing organization to execute faithfully and in detail processes which the experimental and pilot level groups develop.
4) Adequate financial resources and a keen management group capable of maintaining these facilities and personnel and coping with the difficulties of maintaining a sustained effort.

Obviously the aircraft industry has had good experience with some steel castings suppliers and poor results with others. In those instances where poor results were obtained, the organizations involved must not have had all of the above attributes. For the work which the aircraft industry desires, they should seek out only those firms which are so equipped.

In conclusion, it is granted that the steel castings industry may not have satisfied the wants of the aircraft industry to date. However, if the aircraft industry will carefully define its goals in realistic and tangible terms and seek out research organizations and foundries which have the qualifications for the type of development and production work necessary, we feel that steel castings can meet the challenge.

ELIZONDO, *continued*

the data presented were carefully selected to include only those castings for which shape, complexity and material were not new to the foundries involved. In fact, only those sources claiming prior production experience were utilized. Certainly where any development, new design or first run is involved, consideration is given in establishing schedules. The problems discussed by Mr. Rassenfoss are not unique to the foundry industry. They are faced by all suppliers whether they deal with castings, forgings, rolled products, extruded shapes or any other. When the performance of the foundries is compared to that of the other suppliers then foundries merit criticism.

The author agrees with Mr. Rassenfoss on the attributes necessary for a foundry in order to produce high quality castings. At the same time the author cannot help but observe that these attributes are the prerequisites for any well organized, progressive manufacturing concern regardless of the product involved.

As for establishing realistic and tangible goals, this has been done as far as is possible since most of the goals are dictated by our national defense needs. These in turn are not static. They are continually changing. Therefore all industries associated with support of this effort must adjust and learn to operate on these ground rules. It can be done and has been done by many companies and industries today. Steel castings can fill a need and perform a service for the aircraft and missile industry that no other fabrication process can accomplish economically. It is with this goal in mind that the information and data in the author's paper were prepared.

international classification of ferrous cast metals

***EDITOR'S NOTE:** To promote international understanding in alloy terminology, Dr. Wittmoser presents here a proposed system for classification. Comments are solicited.*

by ADALBERT WITTMOSER
Gelsenkirchen, Western Germany

Technical developments in the past decades have led to the creation of numerous new alloys in the field of cast iron. In an effort to combine as many favorable properties as possible, the new alloys possess characteristics often similar to those of previously tested materials. Because of gradual transitions between the new materials and hitherto existing material groups, an easily understandable classification becomes more and more difficult. Numerous misunderstandings and misinterpretations which have occurred in the evaluation of many recently produced cast materials justify the trouble to undertake explanations and new classifications.[1-4]

The user, especially the designer, urgently needs an easily understandable classification system to aid selection of optimum materials for numerous fields of application. The manufacturer, too, should be able to explain the applications as well as limitations of his materials in relation to competing alloy groups. Alloy characteristics and their relations to others must first be established before individuals can be expected to intelligently select the optimum alloy type for the desired application.

Eliminating the nonmetallic cast materials (such as casting resins, gypsum, etc.) this discussion is concerned with metallic cast materials[5] (Fig. 1). These classify easily into cast materials of non-ferrous alloys and iron-carbon alloys. Undoubtedly the *iron-carbon cast alloys* represent the technically most important and the economically most significant group of cast materials.

The term *iron-carbon cast alloys* includes an abundance of materials different in composition and properties. So let's first point out some characteristics all of them have in common. By definition, all these alloys normally possess a high iron content (generally more than 90 per cent). In special cases, the iron percentage of some ferrous cast materials is reduced so much by certain special elements that they hardly qualify as iron alloys. These special alloys possess particular importance in small amounts for singular fields of service (cast permanent magnets, etc.)[6], so they may be considered with *iron-carbon cast alloys*, too.

The second element that characterizes these alloys is carbon. The carbon percentage can range widely from about 0.1 per cent up to 4 per cent.

The close relationship of these alloys is especially noticeable when comparing their microstructures. In all the low-alloyed or unalloyed* irons a large percentage of iron-carbon solid solution (austenite or its decomposition grades) may be seen.

Thus the range in this alloying group nearly encompasses the whole phase diagram iron-iron carbide (Fe-Fe_3C). The three most important groups of ferrous cast materials possess three different fields (some overlapping) in the Fe-C phase diagram[7] (Fig. 2). Here a subdivision of ferrous cast materials appears logical (Fig. 3) and generally corresponds to the phase fields of the Fe-C diagram. Three main designations are:

*Strictly speaking do not count as alloying elements the so-called iron associates: carbon, silicon, manganese, phosphorus and sulphur in the usual percentages.

Fig. 1 — Cast materials classified.

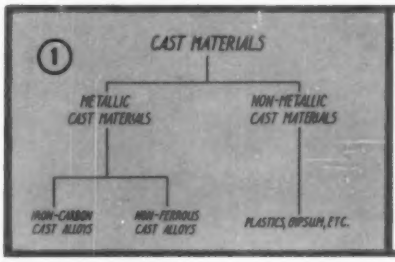


Fig. 2 — Fe-C phase diagram.

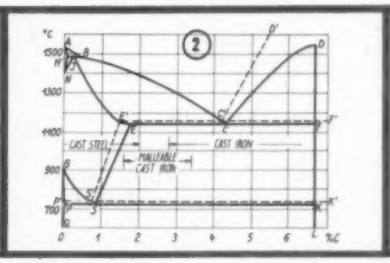
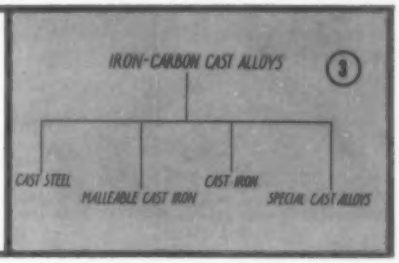


Fig. 3 — Classes of Fe-C cast alloys.



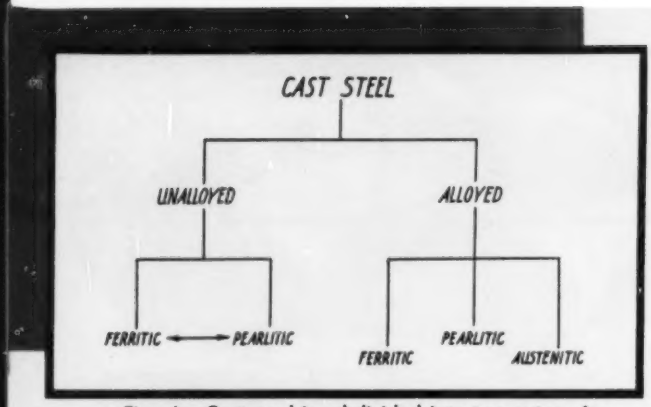


Fig. 4 — Cast steel is subdivided into two categories.

■ *Cast Steel*: Alloys up to about 2.0% C, which contain, as-cast as well as in the working condition, no (or only a small amount of) free carbon (graphite).

■ *Malleable Cast Iron:* Cast materials with from 1.5 to about 3% C. The metallic matrix, as-cast, contain no free carbon but annealing will precipitate free carbon.

■ *Gray Cast Iron:* Cast materials with mostly over 2.5 about to 4% C. The as-cast structure contains most of the carbon content as free carbon (graphite).**

Ferrous cast materials outside of this classification scheme are summarized under the term *special cast alloys* (Fig. 3). A more detailed explanation of these four classifications follows.

Cast Steel

Cast steel is a ferrous cast material; generally free of graphite as cast; contains less than 2.0% C; and has an as-cast structure which can be changed by heat treatment.

The expression *cast steel* includes only steel alloys cast to their final shape in any molding material[8]. It does not include steel cast as semi-finished material such as bars, slabs, which are subjected to further shaping by plastic deformation.

As Fig. 4 shows, this material group can easily be subdivided into unalloyed and alloyed cast steels. Unalloyed cast steels already contain certain percentages of elements termed as "iron associates" (up to 2.0% C, about 0.5% Si, about 0.8% Mn, about 0.08% P, about 0.05% S). The as-cast structure (so called Widmannstatten structure, Fig. 5, left) of cast steels can be changed by a suitable heat treatment (normalization from 30 to 50 C (90-110 F) above Ac_3). The normalized cast steel appears in Fig. 5, right.

Depending on the carbon content, the normalized microstructure ranges from the largely ferritic structure of low-carbon alloys (Fig. 6, left) to the all-pearlitic condition at higher carbon percentages (Fig. 6, right). Furthermore, all decomposition grades of austenite may be obtained by a suitable heat treatment at higher carbon contents (Fig. 7). Attainable mechanical properties distinctly depend on these structures.[9]

The so-called *graphitic cast steels*[10, 11] establish the transition to ferrous cast materials containing free graphite (Fig. 8). Heat treatment produced a partial precipitation of carbon in free form (mostly as spheroids—Fig. 8, left; or nodule—Fig. 8, right). The steel must have a silicon content of 1 to 2 per cent (considerably higher than for common cast steels) and a carbon content of about 1 per cent.

Alloyed cast steels comprise the other division of cast steels. Three basic types of alloyed cast steels are: ferritic alloys containing higher percentages of chromium (Fig. 9, left); pearlitic alloys containing molybdenum, nickel, vanadium, copper, etc.; and austenitic alloys containing nickel, chromium-nickel and manganese (Fig. 9, right).

With increasing amounts of alloying elements, especially tungsten, cobalt, aluminum, the alloy constitution and properties change more and more from that of the regular cast steels. Continuous development of new alloy types often makes it questionable which of these alloys are no longer *cast steels* but *special cast alloys*.

Malleable Cast Iron

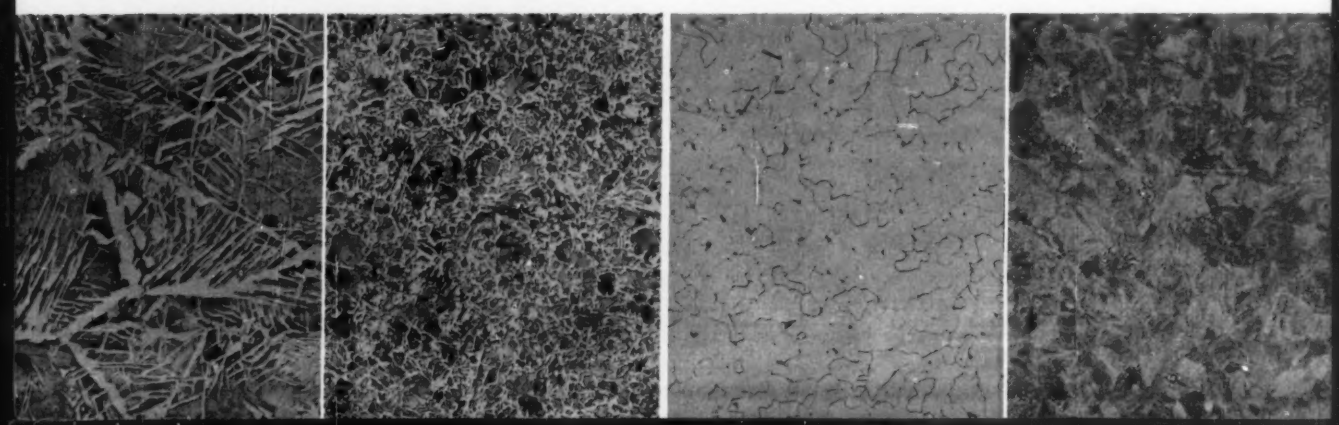
Malleable cast iron is a ferrous cast material; by adjusting the chemical composition and the solidification process it possesses an as-cast cementitic graphite-free structure; after solidification, graphite is precipitated by annealing in a decarburizing atmosphere (for white-heart malleable) or in a neutral atmosphere (for black-heart malleable).

In this definition, malleable iron has been divided into two categories based on the mode of heat treatment after solidification (Fig. 10). *White-heart malleable* is completely decarburized in sections up to

**From the metallographic point of view, pig iron, tapped from blast furnace, if it solidifies gray, belongs to this subdivision. Nowadays the liquid pig iron is rarely cast directly to shapes, so it is more accurately classified as a raw material.

Fig. 5 — As-cast steel, left; normalized, right. 100X.

Fig. 6 — Normalized steels: ferritic, left; pearlitic, right.



about 8 mm (1/3 in.); in greater sections small amounts of carbon may remain. This material practically has the same structure as a low-carbon cast steel (compare Fig. 12, left and Fig. 6, left). Principal difference lies in the silicon content which ranges from 0.6 to 0.8 per cent in the malleable iron.

Black-heart malleable is heat treated in a neutral atmosphere so carbon mostly or completely precipitates in free form as graphite. For this definition the form of the precipitated graphite does not matter; it can vary from the spheroidal shape to the wide spread nodular form (Fig. 11). For favorable mechanical properties, especially high elongation, a true nodular to spheroidal form of graphite is desirable. With the increased lamellar graphite the mechanical properties, especially tensile strength and elongation, become less favorable.

Cementite may decompose into free carbon with nodular form (Fig. 12, right), or spheroidal (Fig. 13, left).[12]

The metallic matrix can be converted to any of the steel microstructures by heat treatment after the decomposition of ledeburite. Usually malleable iron is all ferritic (Fig. 12, right). The possibility of improving mechanical properties by obtaining a pearlitic structure has been investigated extensively during the past decades. As a result a new class of malleable, known as *pearlitic malleable iron*, has come into being. The form of the precipitated graphite (nodular or spheroidal) does not matter (Fig. 13, left and 13, right).[13,14] As in the pearlitic cast steels, pearlitic malleable has decreased elongation values compared to the ferritic malleables.

Fig. 7 — One of the decomposition grades of austenite which can be obtained by heat treating high carbon steels. 500X.

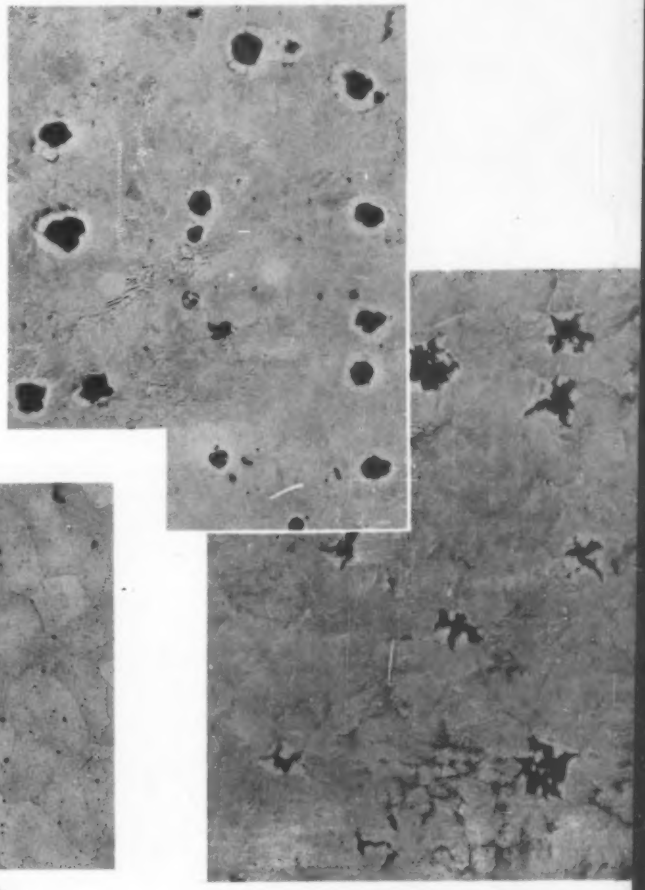


Fig. 8 — Graphitic steels with spheroids, left, and nodular graphite, right. 200X.

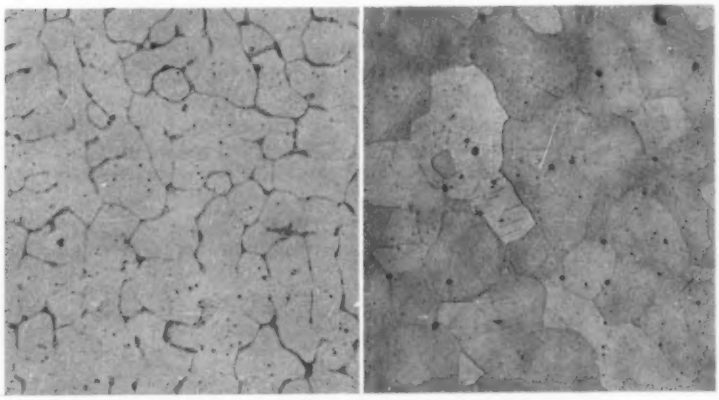


Fig. 9 — Alloyed cast steels may have a ferritic microstructure, left; pearlitic; and austenitic, right. 100X.

Fig. 10 — Malleable cast iron classification.

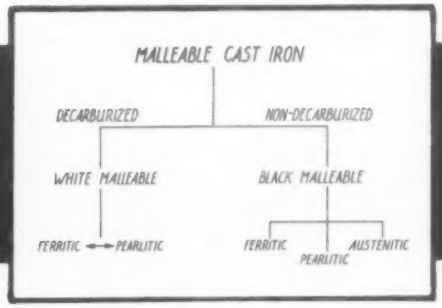
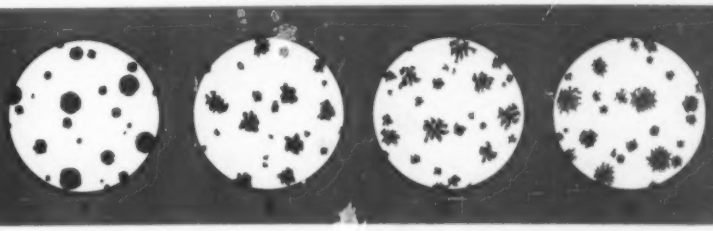


Fig. 11 — Black-heart can vary from spheroidal to nodular.



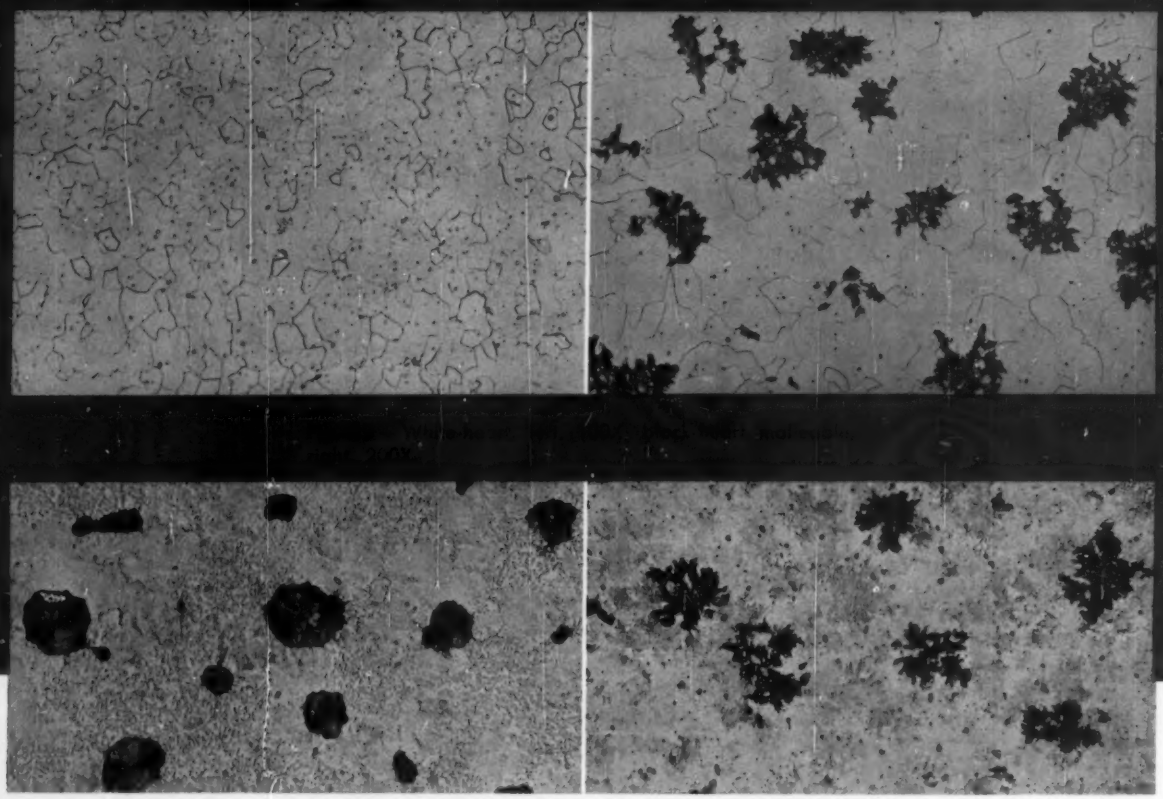


Fig. 13 — Pearlitic malleable iron can have its graphite in spheroidal form, left, or in nodular form, right. 100X.

By addition of suitable alloying elements, especially nickel or nickel-chromium, an austenitic matrix can be obtained.[15] Such alloys are suited for special purposes where physical and chemical properties matter.

With decreasing carbon content, malleable alloys, according to their composition and structure, approach more and more the hypereutectoid cast steels.[16] After decomposition of cementite, a certain or the total percentage of carbon is present in free form. And here we have an overlapping with the graphitic cast steels (compare Fig. 8, left). For instance, certain cast crankshaft alloys, with 1.5 to 2.0 per cent carbon and 2.0 to 2.5 per cent silicon and low percentages of copper and aluminum, were classed as malleable iron[17] (often incorrectly termed "semi-steels"). These alloys could also be classed as cast steels.

On the other hand, the addition of certain elements, such as manganese[18] or sulphur,[19, 20] favors solidification as white iron, but does not prevent the precipitation of graphite by decomposition of cementite. Therefore, the analysis (especially carbon and silicon) can be adjusted in such a manner that it closely resembles that of cast iron (Fig. 17a). Yet these alloys are clearly malleable cast iron since they are cast with a white structure and are annealed for decomposition of cementite.

Cast Iron

Cast Iron is a ferrous cast material; by adjusting the chemical composition and by the solidification process, most of its carbon is present as free graphite in the as-cast condition.

The form of this graphite can vary widely from the lamellar through many intermediate forms to the spherical form (Fig. 14, left and 14, right). Therein results characteristic differences in properties as well as two classifications—cast iron with flake or lamellar graphite and cast iron with nodular or speroidal graphite (Fig. 15).[3]

So the definition for both divisions of cast iron reads:

cast iron with nodular graphite	cast iron with flake graphite
is a ferrous cast material which, by adjusting the chemical composition and by solidification process, has most of its carbon present in the as-cast condition as:	
nodular (spheroidal) graphite	flake (lamellar) graphite

Depending on heat treatment, cooling rates and alloying elements of castings in both divisions, it is possible to obtain a matrix ranging from austenite through the different decomposition grades of austenite (pearlite, martensite, etc.) to all-ferrite (Fig. 15).

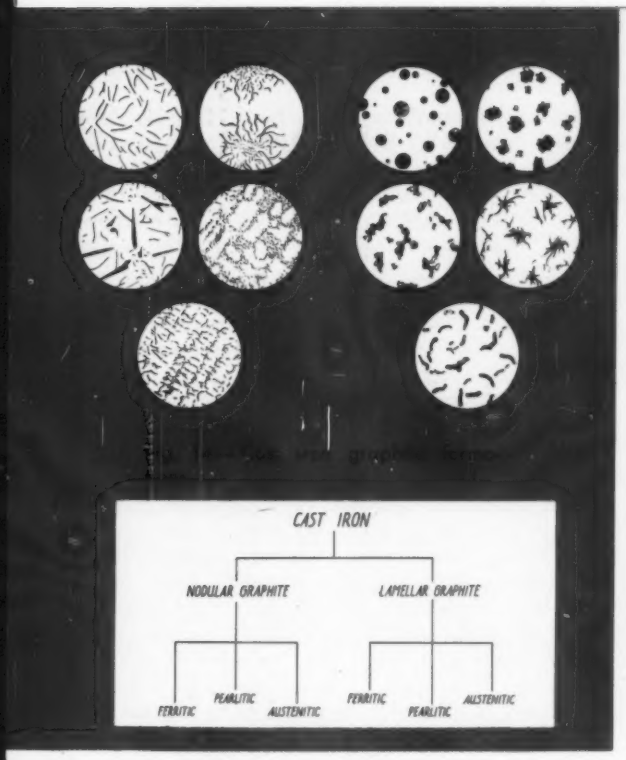


Fig. 15 — Cast iron is classified according to two basic types of graphite.

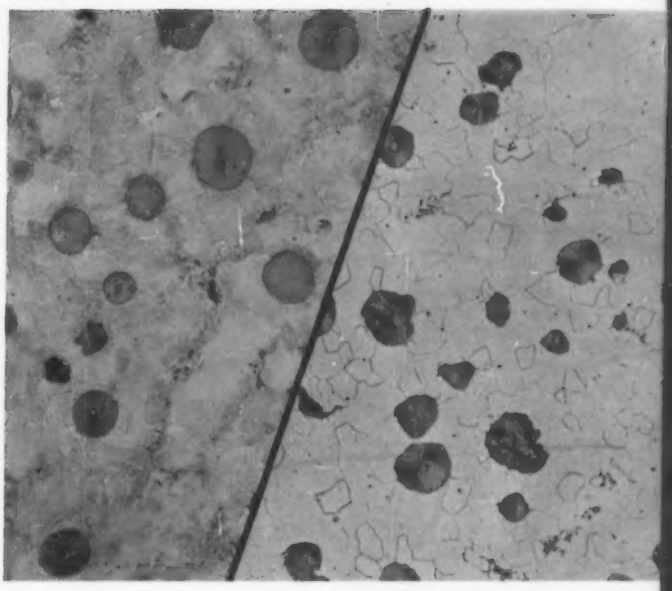


Fig. 16 — Un-annealed nodular cast iron, left, has high tensile and low ductility; with ferritic anneal, right, it has more favorable plastic properties. 100X.

Cast iron with nodular graphite[7] remains un-annealed only if you want high tensile strength and can accept low elongation values (Fig. 16, left). Usually a ferritic anneal obtains the most favorable plastic properties (Fig. 16, right). However, excellent strength properties can be obtained with still remarkable elongation values by a suitable heat treatment.[21] By means of mechanical properties alone it is not easy to distinguish a ferritic nodular iron from ferritic annealed malleable iron with spheroidal graphite. Mechanical properties of these alloys actually produced according to different processes are practically identical.

Photomicrographs do not show a difference in the polished or etched state (Fig. 17a and 17c). Usually the customer does not care which way the material is produced, since he is most interested in the final physical properties. In case of need, an entirely unique identification of the material group may be made with help of an easy, practical metallographic examination, primary etching, demonstrated in Fig. 17b and 17d.[22]

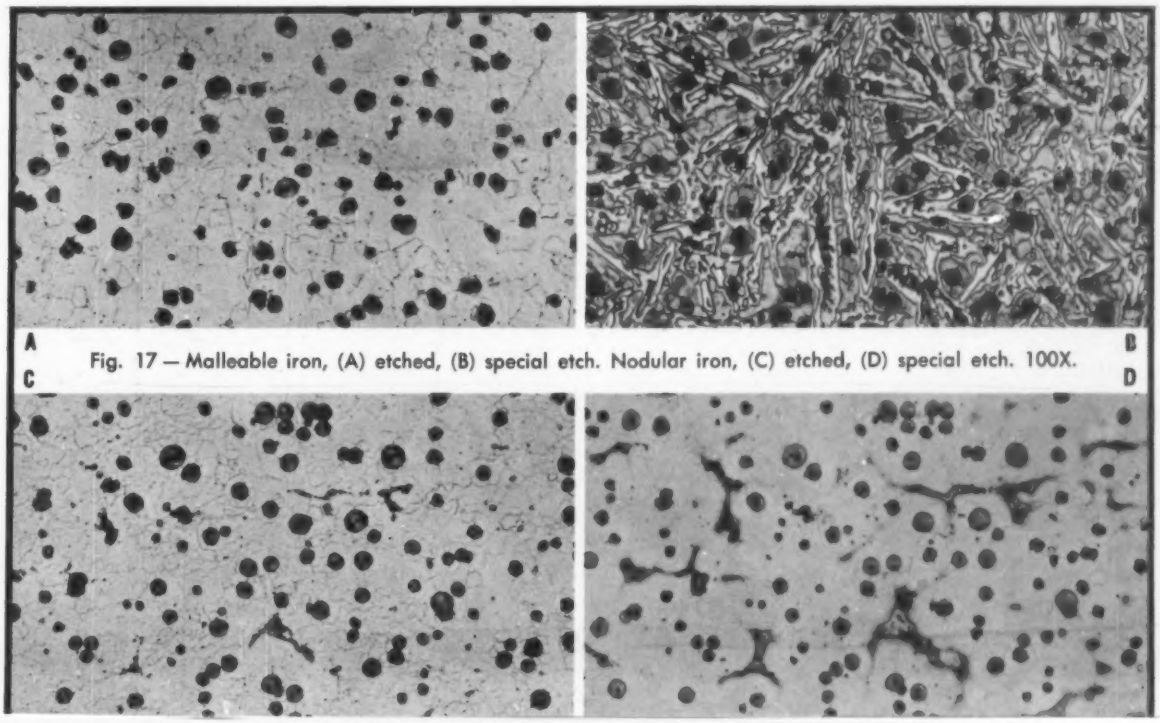


Fig. 17 — Malleable iron, (A) etched, (B) special etch. Nodular iron, (C) etched, (D) special etch. 100X.

Flake graphite cast iron achieves a pearlitic matrix through suitable adjustment of the elements carbon and silicon related to the given cooling rates (Fig. 18, left). But for special properties such as good machinability, the iron must have a ferritic anneal (Fig. 18, right). Concurrently, however, tensile strength values decrease. Most favorable mechanical properties with good elastic behavior result from a suitable heat treatment. Thus, in high nickel-chromium-molybdenum iron, the bainitic structure of acicular cast iron is easily preserved (Fig. 19, left).[23] In the area of *special cast alloys* are the austenitic alloys distinguished by high nickel, nickel-chromium, or manganese content (Fig. 19, right).

With normal alloying elements present in iron-carbon cast alloys of more than 2.0% C, the as-cast graphitic and ledeburitic structures depend predominantly on solidification conditions. For instance, alloys cast in metallic molds, such as centrifugal cast pipe,[24] may be considered similar to chill-cast iron. These alloys are not used as-cast like chill-cast, but receive a short heat treatment to remove the thin cementite rim zone developed by the chill mold.

On the other hand, those alloys which crystallize completely white by casting in metallic molds and graphitize after annealing belong to the field of malleable cast iron, even if they would solidify with precipitation of free carbon when sand cast.[3]

Special Cast Alloys

Special cast alloys include all iron-carbon cast alloys which cannot be classified into the groups cast steel, malleable cast iron and cast iron. These alloys are mostly cast iron alloys distinguished by special mechanical, physical and/or chemical properties—often with high-alloying percentages (Fig. 20).

Another common characteristic of *special cast alloys* is their extraordinary brittleness that distinguishes the ledeburitic as well as the graphitic alloys likewise.

Only the alloys of white cast iron and of chill-cast are low-alloyed or unalloyed, respectively. All the other components of this group represent high-alloy materials.

White cast iron is classified in this group in spite of having basically the same constitution as unannealed malleable cast iron (Fig. 22, left). The significant difference between white cast iron and unannealed malleable cast iron is that: white cast iron is already in the state of use after its graphite-free (ledeburitic) solidification, whereas unannealed malleable cast iron is only in a transition stage prior to final heat treatment. In addition, white cast iron alloys generally have a really higher carbon content (3.5 per cent and more) than unannealed malleable cast iron. This leads to a maximum of ledeburite which has an especially good durability against abrasion.

On the contrary, chill-cast, likewise suitably attached to the *low-alloyed special cast alloys*, is in the limiting area of cast iron. These alloys are used for high abrasive resistance of surface sections, especially for chilled roll iron. Roll makers get a rather thick ledeburitic rim by using chill molds. However, the soft inner section corresponds to the structure of the common cast iron (with nodular (spheroidal) or flake (lamellar) graphite).

Fig. 18 — Flake graphite iron with pearlitic matrix, left; and ferritic matrix after anneal, below. 100X.

Fig. 19 — Austenitic special cast iron structure, right; and high alloy acicular iron with bainite, below. 500X.

The *high-alloyed special cast alloys* can be classified into graphitic and ledeburitic alloys—based on their as-cast microstructure. For completing the classification, *low carbon special cast alloys* may be mentioned. These are distinguished by especially high-alloying percentages of the elements cobalt, aluminum, chromium, tungsten, etc., so that their iron content may drop to 30 per cent or even lower.[6] Such alloys are generally used for their special magnetic or chemical properties.

In the case of *graphitic special cast alloys*, it suffices merely to mention that they contain silicon and aluminum. Extremely corrosion resistant materials[25, 26] are obtained by adding about 15% Si or 8 to 10% Al. The high aluminum irons endure high thermal stresses without considerable oxidation. High silicon irons resist practically all the corrosive actions (Fig. 21, left and 21, right).

Ledeburitic special cast alloys contain carbide-forming elements and alloying elements as high as 30 per cent or more (Fig. 22, right). When classifying high-chromium alloys, there is a certain overlapping with cast steel. If these alloys have low carbon contents, they are sometimes termed *high-alloy cast steel*. Generally, the high alloy cast steel does not have high ledeburite content and the brittleness connected with it. Finally this scheme of classification has still space for special cast alloys with further specific alloying elements like molybdenum, tungsten, etc., but at present they are rather unimportant.

Outlook

The relations of the particular groups to each other are derived from the as-cast microstructure in most cases. The exact pursuance of this determination occasionally leads to certain difficulties. For example, alloys, which finally appear with nodular graphite in a ferritic matrix (Fig. 17a and 17c) are classed as cast iron or malleable cast iron according to their manufacturing method.

So in certain cases the structure in the state of use is a decisive characteristic for the definition. But if you proceed from the structure present in the state of use, white malleable cast iron (i.e. decarburized by annealing, (Fig. 12, left) would be classed

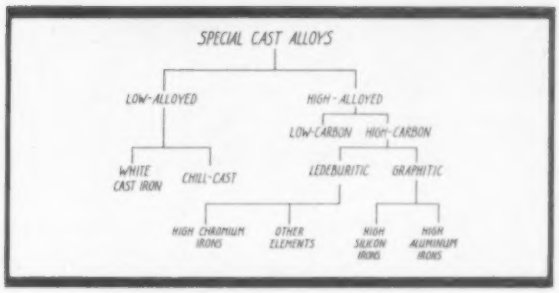


Fig. 20 — Special cast alloys are classified into low- and high-alloyed.

as (low-carbon) cast steel. White-heart malleable cast iron has predominantly ferrite in the state of use (after a decarburizing anneal) like cast steel (Fig. 6).

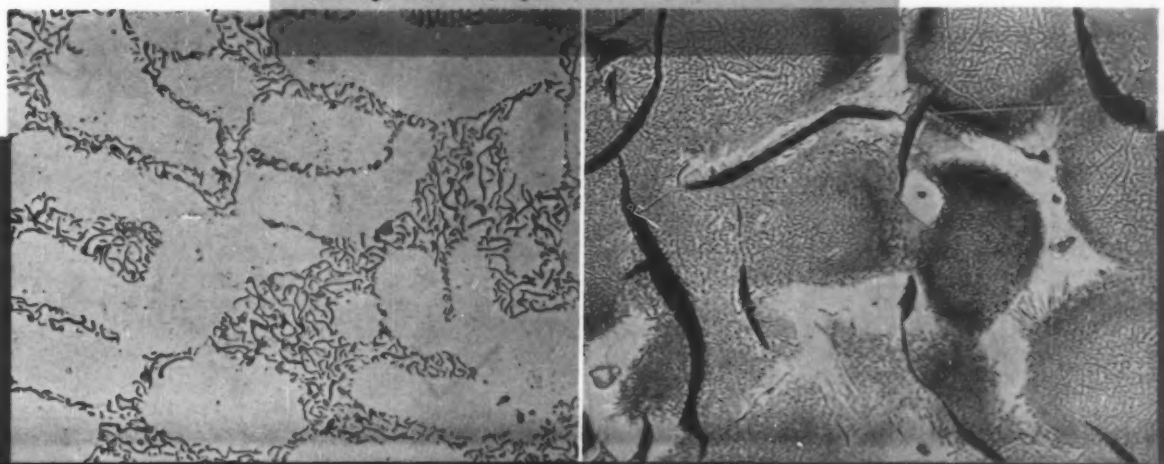
A grouping of white-heart malleable cast iron and of ferritic cast steel in one alloying group would ignore the terms used for decades. The type of malleable cast iron with nodular graphite has become a fixed term, too.[20, 27, 28] So it seems more practical to put up with the little overlapping of conceptions in the case of iron-carbon cast alloys with spherical graphite only developed in the last two decades.

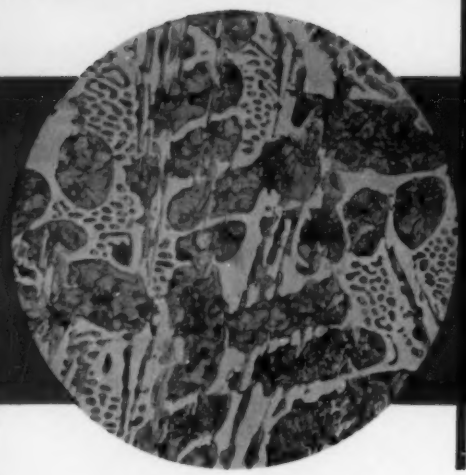
Transition Alloys

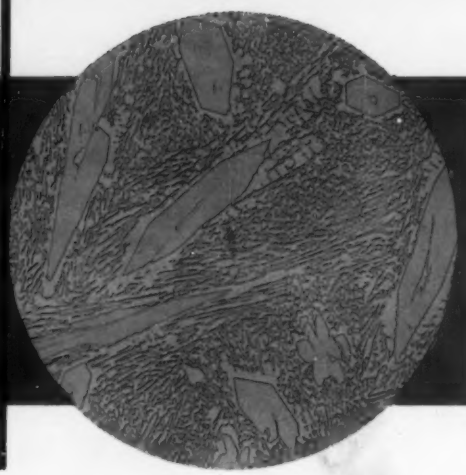
In spite of the definitions illustrated above the four groups have numerous transitions where a distinct coordination is not easy. For example, the ledeburitic cast steels for drawing dies with slightly more than 2% C are in the field of special cast alloys (white cast iron). On the other hand, the low-carbon malleable cast iron alloys with about 1.4 to 2.0% C and about 1.5% Si are really in the field of cast steels. The so-called graphitic steels are situated according to composition and constitution in the limiting area between cast steel and malleable cast iron (or even cast iron).

Finally, most high-alloyed, cast ferrous materials (such as high chromium, high aluminum and high silicon irons) are hard to classify according to their carbon contents like cast iron and cast steel. Therefore, they are considered separately under the term special cast alloys. Yet ferritic cast steels with chro-

Fig. 21 — Graphitic special cast alloys: high silicon, left; and high aluminum, right. 500X.







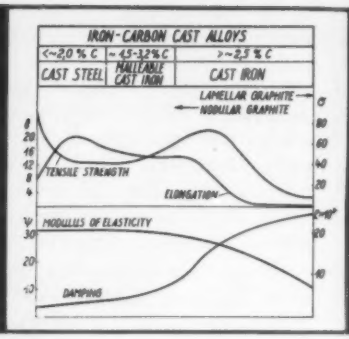


Fig. 23 — Iron-carbon cast alloys as a continuum.

Fig. 22 — Ledeburitic special cast alloys: low alloy (white iron), left, 500X; high alloy, right, 100X.

mium contents up to 30 per cent and more have been called alloyed cast steel for a long time.

The definitions developed in this paper represent a unique systematization of the technically important types of iron-carbon cast alloys. Special effort has been made to accommodate traditional conceptions along with new metallurgical developments. Ordinary consideration distinctly shows smooth transitions in characteristic properties of the alloy groups. Figure 23 shows how some specific properties, important for the use of materials, continuously change and overlap within the range of the three basic groups.

This fact can help the manufacturer choose suitable alloys for the desired purpose of application. Also the consumer can realize how many selections of iron-carbon cast alloys are available for different uses.

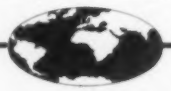
Summary

The technical development of the past decades seem to make necessary a checkup and revision of the already known division of iron-carbon cast alloys. However, the author feels that the traditional conceptions should be retained. Besides the groups cast steel, malleable cast iron, and cast iron, those alloys not suitably classified in the three main groups were identified as *special cast alloys*.

Those iron-carbon cast alloys with spherical graphite were logically classified as cast steel (graphitic cast steel), malleable cast iron and cast iron. Malleable cast irons with spherical types of graphite have the production advantage of short anneal. On the other hand, introduction of gray solidifying types of cast iron with nodular graphite has closed the gap that previously existed between malleable cast iron and cast iron, especially regarding the plastic properties.

As far as possible, alloy group classifications were made as clear and systematic as possible. However, it should be remembered that there are no sharply separated material groups; but these material groups represent a "continuum" within which they smoothly change into one another. This continuum enables the manufacturer as well as the consumer to choose the best suitable iron-carbon cast alloy for any specific application.

EDITOR'S NOTE: Modern Castings wishes to thank C. K. Donoho, American Cast Iron Pipe Co., Birmingham, Ala. for his liaison assistance in making possible the publication of this article.



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Add Ten New Courses to '60 AFS-T&RI Training Program

■ Ten new courses, ranging from blueprint reading to metallurgy, will be presented for the first time in the AFS-T&RI 1960 program. These were selected as essential industry-wide courses best suited for in-plant personnel training.

Industry support of the program has lead to its continual expansion since the first presentation in 1957. To date over 1200 students from 35 states, Canada, Mexico, South America and Europe have attended the 35 courses. The program serves a threefold purpose: to provide a plan for progressive in-plant advancement; to create up-grading opportunities of existing personnel and to enable management to realize greater personnel efficiency combined with improved technology.

Further support of the plan has come from nearly 80 experts in all phases of the industry who have contributed their time as instructors.

The 1960 program begins Jan. 11-15 in Chicago with *Cupola Melting of Iron*, the best attended T&RI course. Designed for cupola operators, supervisors, metallurgist and foremen, it covers basic principles for efficient cupola operation. Fee, $90.

The second course, also repeated by numerous requests is *Gating & Risering of Castings* to be held Feb. 3-5 in Chicago. It covers theory and practice on problems relating to gating and risering of ferrous and nonferrous alloys. Fee, $60.

The 1960 program with asterisks denoting new courses.

1	Cupola Melting of Iron	Jan. 11-15
2	Gating & Risering	Feb. 3-5
3	Metallurgy of Ferrous Alloys*	Feb. 22-24
4	Melting & Heat Treatment of Malleable Iron*	March 7-9
5	Casting Design & Stress Analysis*	March 28-30
6	Shell Cores & Molds*	April 11-13
7	Production of Ductile Iron*	June 27-29
8	Blueprint Reading & Estimating*	July 11-13
9	Welding & Brazing of Cast Metals*	Aug. 17-19
10	Core Practices	Aug. 29-Sept. 2
11	Foundry Refractories*	Sept. 12-14
12	Economical Purchasing of Foundry Materials*	Sept. 26-28
13	Sand Testing	Oct. 10-14
14	Foundry Plant Layout	Oct. 24-26
15	Metallurgy of Light & Copper-Base Alloys*	Nov. 7-9
16	Sand Control & Technology	Dec. 5-7

It is expected that as in the past, several AFS chapters will co-sponsor AFS-T&RI courses. Several chapters have expressed an interest and details will be announced at a later date.

Urge Early Participation in National Apprentice Contest

■ Early participation in the AFS 1960 Apprentice Contest is urged to prevent the complication of administrative details. Since only one molding pattern is available for each local contest, a routing schedule must be developed by the AFS Education Director.

Where the number of contestants in local areas becomes large, it also demands careful pattern scheduling by the contest chairmen. In addition, early organization at the local level leads to better administered chapter and plant contests.

The following will speed the conducting of local contests.

■ Appoint one person as the official contact for all correspondence with the National Headquarters concerning the contest. Submit this name promptly to the AFS Central Office, Golf & Wolf Roads, Des Plaines, Ill.

■ All equipment and supplies, other than blueprints, patterns and contest forms are to be furnished by the contestant or his shop.

■ Prior to the actual receipt of entries for judging, all contest activities and correspondence should be addressed only to the AFS Education Director.

■ Furnish names, companies and respective divisions of entry of all intended contestants when applying to the Central Office for blueprints and patterns.

Drawings and patterns for national competition have been provided through co-operation of industry. Garvey Pattern & Mfg. Co., South Bend, Ind., produced the master tracings for the wood and metal patternmaking divisions. George Garvey is Chairman of the Apprentice Contest Committee of the AFS Education Division.

Scientific Cast Products Corp., Chicago, furnished the pressure cast aluminum patterns for the iron, steel and non-ferrous molding competition. Cleaning and finishing of the patterns was done by the patternshop of Caterpillar Tractor Co., Peoria, Ill.

AFS 1896

news and views

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Michigan Regional Emphasizes ■ ■ ■

■ New developments in molding, melting, material, design and marketing were presented at the Michigan Regional Foundry Conference held Oct. 8-9 at the Pantlind Hotel, Grand Rapids, Mich.

D. L. Jacobson, Grand Haven Foundry, Grand Haven, Mich., was conference chairman, V. J. Sadler, General Foundry & Mfg. Co., Flint, Mich., was conference vice-chairman.

The AFS Western Michigan Chapter served as host. Other sponsors were the Central Michigan, Saginaw Valley, and Detroit Chapters and the student chapters of the University of Michigan and Michigan State University.

Ferrous and non-ferrous sessions were conducted at the two-day conference.

General Sessions

BLASTING, G. O. Pfaff, Wheelabrator Corp. Blast cleaning costs can be system of checks involving operating efficiencies and cost controls. Operating controls include—1) reading ammeter connected in wheel circuit, 2) hot spot checks, 3) screen analysis of operating mixtures, 4) controlled additions of abrasives, 5) checks on housekeeping, 6) check on performance of dust collector venting the blast machine. Establish cost controls on a per wheel hour basis. Include —1) wheel hour meter connected in the wheel circuit to measure blasting hours, 2) an operating record indicating all production put through on machine, abrasive additions and any other occurrence with wheel hours recorded, 3) maintenance record on parts and labor with wheel hour meter reading at time work was performed, 4) sheet for posting and accumulating operating and maintenance records.

GRINDING, B. Chenevert, Ford Motor Co. Economical grinding operations start with the selection of the proper wheel, a compromise between work speeds and feeds giving maximum life, and those giving easier cutting and high production rates. In daily production, economies can be effected by use of daily records of production and consumption, control of wheel changing and matching of work with correct wheels.

QUALITY, R. Leppien, Central Foundry Div., General Motors Corp. When a casting is commercially clean must be answered on an individual basis, considering foundry operations and customer requirements. Foundry influences include casting quality as it leaves shakeout, heat treating operations, storage facilities before and after cleaning, processing operations and degree of inspection. MILLING, was explained by R. Wigger, Ransohoff, Inc.

NOISE ABATEMENT, H. J. Weber, AFS Director of Safety, Hygiene & Air Pollution Control Program. Weber outlined fundamental principles of noise and noise control, citing examples of practical control in various foundry operations. Abatement may be secured by isolation of the man, isolation of a noisy operation, substitution by a less noisy operation, control by distance, enclosures of insulators and control of reflected noise by acoustical material.

JOB POTENTIAL AND OPPORTUNITIES IN THE FOUNDRY INDUSTRY, E. Frens, Foundry Div., General Electric Co. In a special session for students, Frens stated that tremendous opportunities exist in the industry for technically trained men. Dynamic forces in the American system will mean an expanding economy, this coupled with new markets and new technology means an excellent opportunity for technical personnel. In addition to research, engineering and manufacturing, other openings are in sales, development, process and quality control, ceramics, standards and technicians.

DIVERSIFICATION FOR THE FOUNDRY AND MEANS OF SURVIVAL. "Diversification of the Process," Sam Hodler, Golden Foundry Co. Foundries must diversify to meet competition employing an aggressive offense based on technical research, product development and education. Since no one process can do all jobs best, all new techniques must be studied and consideration given to those which can make the job with greater profit while giving greater customer satisfaction.

"Diversifying the Customer," Wm. Truckenmiller, Albion Malleable Iron Co. Customers in widely diversified industries give stability to foundry operations. Prior to seeking new customers, studies must be made of the foundry's present position including physical facilities, manpower, past accomplishments and immediate prospects.

"Need and Willingness to Satisfy the Customer," Walter Szott, Central Foundry Div., General Motors Corp. Four steps in satisfying customers in an era of more stringent specifications include statistical quality controls, improved inspection devices, customer follow-up, co-operative engineering.

DIRECTIONAL SOLIDIFICATION AS RELATED TO DESIGN, W. P. Dudley, Ohio Steel Foundry. Advantages of designing castings with tapered wall thickness as a means of securing uniform directional solidification were emphasized. Improper design, rather than poor control, is frequently a major cause of castings defects. The correct design of a casting, based on directional solidification, should be the first step in producing a quality product. To this end early consultation between the user and producer of castings is needed to es-

Delivering luncheon talk on "Noise Abatement" is **H. J. Weber**, AFS Director of Safety, Hygiene & Air Pollution Control Program. Conference was held at the Pantlind Hotel, Grand Rapids, Mich.

▪ ▪ ▪ Latest Foundry Developments

tablish a casting design that is both satisfactory to the customer and acceptable to the producer from a quality standpoint.

PROPER GATING THROUGH USE OF COBALT-60, Kenneth F. Spray, Central Foundry Div., General Motors Corp. Non-destructive testing by use of cobalt-60 radiography has aided in improving the quality of castings and in designing gating layouts. It has also helped establish inspection standards for other methods.

Other general session speakers were Richard C. Bates, M.D., who spoke on "How to Have A Heart Attack," and F. B. Porzel, Armour Research Foundation who presented "Atomic Blast—A Pattern for Survival."

Non-Ferrous Talks

METAL EFFICIENCY IN MAGNESIUM CASTING OPERATIONS, F. C. Bennett, Dow Metal Products Co. In sand foundries and die casting plants processing magnesium alloys, excessive metal losses can be explained and more readily controlled by means of material balance studies. Flow charts can be used to develop the role of casting efficiency and poured ratio for any combination of the unit loss variables.

CONTROLLED PRODUCTION, L. E. Capek, Du-Wel Metal Products, Inc. Since controlled production is a basic concept it must be developed throughout the entire organization. It is not confined to quality control personnel. Management, engineers and production supervision are also involved in the building of quality compliance into a product. Although control may be achieved through statistics, and regulated through charts, forms and graphs, the human element is the most important ingredient in the solution of the problem through the planning and direction of this approach.

SYNTHETIC SANDS FOR NON-FERROUS CASTINGS. T. E. Barlow, Eastern Clay Products Dept., International Minerals & Chemical Corp. Sands for non-ferrous castings are now seeking higher green strength through the use of flowability additives and harder ramming. Barlow compared natural sands with synthetic sands and warned that the use of synthetics calls for new techniques.

COMBUSTION AND MELTING IN NON-FERROUS FOUNDRIES, A. C. Schmid, Joseph Dixon Crucible Co. In an illustrated lecture explained procedures for determining oxidizing and reducing flame efficiencies in gas and oil-fired furnaces. Outlined use of manual chemical absorption type instrument for determining CO, CO_2, and O_2.

Ferrous Talks

CONSTRUCTION AND TRENDS IN WATER-COOLED CUPOLAS, Jack Goudzwaard, Neenah Foundry Co. The complete water-cooled cupola without lining used under the proper operating conditions permits a flexibility almost impossible any other way. The transition from the conventional lined stack to water-cooled cupolas without a lining can be done gradually. First step might be the application of water on the outer shell to prevent occasional hot spots which may occur on extended heats.

Next could be the installation of water jackets or glands inside the conventional cupola over which a lining may or not be placed. After the installation of jackets or glands, it may be necessary to install water-cooled tuyeres. The final step is a lining-free cupola, water-cooled from below the charging door to the bed plate.

HIGH-STRENGTH AND NODULAR CAST IRON, R. A. Clark, Union Carbide Metals Co., Div. Union Carbide Corp. In the future greater stress will be placed on precision and metallurgy. Signs point to customer specifications requiring accurate control of microstructure in critical areas, use of specifications involving the determination of hardenability for castings to be heat treated; better correlation of the controlling section of casting with the test bar used to qualify the metal.

Others may include a wider use of specialized cast irons to meet unusual conditions, a better understanding of control and the influence of incidental elements and use of inherent properties of cast iron. Clark also sees lighter and stronger castings in automobile engines and a rapidly growing market for ductile iron where high strength is a prerequisite, partly at the expense of stronger graphite iron.

MALLEABLE BASE SPHEROIDAL IRON, John T. Bryce, Albion Malleable Iron Co. Described a new ferrous graphitic casting material melted in acid cupola, electric arc or cupola duplex combination. Its liquid shrinkage and general feeding characteristics are similar to pearlitic malleable except that the freezing temperature is lower and fluidity improved. It may be cast in upwards of a 6-in. cross-section without mottle or inverse chill and on heat treatment produces properties in excess of 65,000 psi in heavy sections.

Making final arrangements for Michigan Regional Foundry Conference are: **James Vander-Meulen,** American Seating Co., program committee; **Charles Cousineau,** Carpenter Brothers Co., program committee; **Jess Toth,** Harry W. Dietert Co., executive secretary-treasurer; **D. L. Jacobson,** Grand Haven Brass Foundry, general chairman; **V. J. Sadler,** General Foundry & Mfg. Co., general vice-chairman; **Robert Dodge,** Foundry Services, Inc., arrangements committee.

Industry Has Tools ■ ■ ■

AFS National Director **H. G. Stenberg**, second from right, and members of the **New England Regional** conference committee.

■ Competition facing foundries can be met to a large degree by better utilization and improvement of information and techniques now available. Practical application of existing data was emphasized by speakers at the 19th New England Regional Foundry Conference held Oct. 16-17 at Kresge Auditorium, Massachusetts Institute of Technology, Cambridge, Mass.

The AFS New England Chapter was host with former chapter president W. N. Ohlson, Draper Corp., Hopedale, Mass., acting as conference chairman. New England Chapter President A. A. Erkkinen, Fremont Casting Co., Worcester, Mass., was conference vice-chairman. Stafford W. Chappell, General Dynamics Co., Groton, Conn., was non-ferous program chairman and John F. Dwyer, Shell Process, Inc., West Springfield, Mass., was ferrous program chairman.

AFS organizations sponsoring the conference with M.I.T. were the New England and Connecticut Chapters and Student Chapters at M.I.T. and Wentworth Institute.

Other organizations assisting were Connecticut Foundrymen's Association, Boston Chapter, Non-Ferrous Foundrymen's Association, Connecticut Non-Ferrous Foundrymen's Association, Providence Non-Ferrous Foundrymen's Association, Pine State Foundrymen's Association, Northeastern University and Tufts University.

Foundrymen were welcomed to the conference by Gordon Brown, Dean of Engineering, M.I.T., who commented on the scope of subjects to be discussed.

AFS National Director, Henry G. Stenberg, Draper Corp., Hopedale, Mass., spoke on current development at AFS headquarters.

Ferrous, non-ferrous and general sessions were conducted during the two-day program.

General Talks

IMPORTANCE OF LABOR COST CONTROLS, **George E. Meyers,** consultant. Proposed a control program, based on past performances using man-hours as a yardstick. After obtaining a six-month average, the plan is put into effect employing a ten-week moving average. At the 11th week, new figures are added and the oldest dropped. Historical and current costs may then be compared, crediting or debiting current operations. Next, variables can be eliminated by compiling various figures such as cost per piece, cost per mold or cost per 1000 lb. Meyers stated that the average day worker is 66 per cent effective. A practical cost plan will point out areas in which production can be improved.

OCCUPATIONAL DISEASES IN FOUNDRYMEN—FACT AND FALLACY, **H. J. Weber,** AFS Director of Safety, Hygiene and Air Pollution Control Program. Massachusetts has the highest workmen's compensation of any state in the country, Weber pointed out. He advised foundry management that considerable savings are possible through a better understanding of the various laws. Weber discussed the basic philosophy of workmen's compensation, types of laws and insurance, employers' responsibility and inequities. Among occupational diseases covered were silicosis and aluminum therapy. Misconceptions concerning various diseases were also pointed out.

RECENT DEVELOPMENTS IN THE MELTING OPERATION, **Fred C. Barbour,** Republic Steel Corp., Cleveland. Described a means for reducing the sulphur content of iron melted in acid-lined cupolas to as low as 0.25 per cent. Equipment includes a hopper or container located close to the cupola and above the tuyeres. Dense soda ash or soda ash and calcium carbide is fed from the hopper into a tube projecting horizontally into one of the tuyeres. Compressed air injects the material into the cupola.

Barbour also told of a simple hot-blast installation for cupolas using a series of vertical tubes connected to a wind box located just below the charging door of the cupola and projecting to the tuyere area on the inside of the shell. A refractory lining is rammed around the tubes with an insulating material placed between the tube and cupola shell to minimize heat loss. Air blast enters into the wind box at the top of the cupola and in passing through the vertical tubes is heated to 350-400 F. The melting rate is high compared to conventional type cupolas and the iron to coke ratio is between 12:1 and 17:1.

THE SANDS OF TIME AWAIT NO MAN, **Kurt A. Miericke,** Baroid Chemicals, Inc., Chicago. Sand control is common sense applied to conditions in the shop. Highly important is the man on the muller who is as vital as any man in sand control. Suggestions on obtaining better sands were—work sand as dry as possible, keep clay content low, avoid excessive fines, constantly control ash con-

Speakers **Prof. J. F. Wallace** and **David Matter** discuss metallurgical problems.

▪ ▪ ▪ to Beat Competition

tent, reduce riddling, avoid too much handling except when properly mulling, avoid heavy additions of new sand, avoid long mulling and unnecessary movement of sand, develop a regular routine in mulling, test regularly for permeability, green strength and moisture.

Miericke stressed that production of castings with a narrower range of physical properties will permit design engineers to redesign castings with smaller safety factors, reduce costs and allow competition with forgings and weldments.

Non-Ferrous Talks

NICKEL AND THE NON-FERROUS METALS, **G. L. Lee,** International Nickel Co., New York. Plastics, light metals and forgings are making serious cuts into the production of copper-base alloys. Lee discussed nickel-tin bronzes, nickel-aluminum bronzes, cupro nickels and red brass and tin bronzes with 1-3 per cent nickel additions which can open the doors to new applications. In addition to finding new uses, Lee warned that non-ferrous foundries must exert stricter control methods, adopt new metallurgical advances and conduct a more aggressive selling program.

ALUMINUM CASTING QUALITY CONTROL, **Donald L. LaVelle,** American Smelting & Refining Co., South Plainfield, N. J. Attacked the problem of quality control by outlining five internal defects of a metallurgical nature. Metallic inclusions consist of (1) **Dross and Oxides;** hard spots usually encountered during machining are primarily aluminum oxide; molten aluminum should not be mixed with air at any time. (2) **Flux,** LaVelle recommended flux only for reducing dross; flux inclusions usually cause blooming of the castings.

Porosity defects are caused by (1) **Gas,** hydrogen gas is formed by the reaction between molten aluminum and moisture; may be corrected by suitable degassing. (2) **Shrinkage,** aluminum alloys decrease in volume when changing from a liquid to a solid causing porosity when improper or inadequate gating, risering and chilling are used. (3) **Entrapped air,** appears as porosity just beneath the skin of the casting on the cope side, usually associated with the gate area.

OBTAINING PHYSICAL PROPERTIES OF ALUMINUM BRONZE AND ALUMINUM MANGANESE BRONZE, **Raymond D. Turner,** General Dynamics Corp., Electric Boat Div., Groton, Conn. Described the development of a test correlating Brinell hardness with a chill bar mold test block to control physical properties of high tensile bronzes. The test which takes less than five min, has cut rejected heats to five per cent. Brinell ranges have been developed for various alloys to achieve maximum physical properties. Charts indicate the amount and type of additive to replace metals lost through burnout.

Ferrous Talks

DUCTILE IRON—PRODUCTION AND CONTROL TECHNIQUES, **Harvey E. Henderson,** Lynchburg Foundry Co., Lynchburg, Va. Strict control of all phases from blueprint to inspection are needed to produce quality ductile iron castings. Metallurgically, close control of composition is essential to produce castings consistent with as-cast properties. Henderson recommended a foundry methods department similar to that at Lynchburg which is charged with the responsibility of determining the most economical and satisfactory way of producing castings. Key men are the pattern estimator, foundry estimator and gating and risering technician. Sizes of gates and risers are calculated from established formula based on fluid flow and heat transformation. Location of runners, ingate and risers is determined by basic rules and practical information.

Prior to production, a pilot run is made in the shell foundry. The inspection department makes a thorough investigation including checks for molding defects and dimensional accuracy. Discrepancies are corrected by the methods department.

WHAT ALLOYS CAN DO FOR THE SMALL FOUNDRY, **David Matter,** Ohio Ferro-Alloys Corp., Canton, Ohio. Small foundries can secure more than one metal from a heat through ladle inoculations. Jobbing shops doing a variety of work depend on inoculation and alloying techniques for broadening the scope of their operations.

Inoculations allow the melting of lower silicon base iron and the use of silicon additions in the ladle produces a stronger iron but at the same time one not as hard in the thin sections and not as soft in the heavy sections. Inoculation minimizes the section sensitivity of cast iron at a cost easily justified.

GATING AND RISERING OF FERROUS CASTINGS, **Prof. John F. Wallace,** Case Institute of Technology, Cleveland. The gating of all castings follows simple rules that are generally applicable. The mold cavity should be filled rapidly enough to avoid laps and yet not so rapidly that erosion of sand results. Metal damage and air aspiration should be avoided and slag provided with an opportunity to be removed before the metal enters the mold cavity. The theoretical objective can be accomplished with a modified Eastwood gating system adusted to provide the proper rate of pour.

The risering of castings is designed to remove the shrinkage defects, including sinks or surface depressions. In general, risers should have sufficient volume to compensate for liquid and solidification contraction and any mold wall movement which occurs. It is usually necessary for the riser to remain liquid longer than the casting. The general risering case applies to steel and mold wall movement is not much of a problem.

However, neither gray nor ductile iron follow the general case. The eutectic solidifies with an expansion and the two metals have a mushy type of solidification so that mold wall movement is much more of a problem than solidification contraction. Therefore, the risering practice for steel may be standardized according to given rules, but the practice used for gray and ductile iron depends on the composition of the irons and particularly on the type of mold used and resulting mold wall movement.

D. L. LaVelle, right, outlines talk to technical chairman **Edgar Gotthold** at New England Regional. LaVelle spoke on aluminum quality control, outlining defects and cures.

200 AT EMPIRE STATE

Drumlins Country Club, site of the Empire State Regional Conference.

■ The Drumlins Country Club, Syracuse, N. Y., provided a beautiful setting Oct. 1 and 2 for the Empire State Regional Foundry Conference. In spite of stiff competition from the televised World Series and a steady, light rainfall, the two-day conference sent some 200 foundrymen back to their jobs with far from dampened spirits regarding the future of their industry.

Individual foundry problems, whether involving plastics for pattern-making; sand for mold and coremaking; or castings design, gating and production; were answered by experts. Coupled with theory were the benefits of on-the-spot plant visitation; two separate tours each morning took interested foundrymen to Oberdorfer Foundries, Inc.; Crouse-Hinds Co.; Pattern Makers, Inc.; and Meloon Bronze Foundry, all of Syracuse.

The Honorable A. A. Henninger, mayor of Syracuse, welcomed the 200 persons attending the conference, which was sponsored by six AFS chapters: Central New York (host chapter), Eastern New York, Northwestern Pennsylvania, Western New York, Rochester, and Ontario.

General Conference Chairman was D. J. Merwin, Oriskany Malleable Iron Co., Oriskany, N. Y.; Program Chairman, R. P. Watson, Chicago Pneumatic Tool Co., Utica, N. Y.

Sokolowski Stresses Effect of Coke Size on Cupolas

Better Gray Iron by W. A. Sokolowski, Remington Rand Co., Div., Sperry Rand Corp., Ilion, N. Y.

In discussing problems facing the gray iron foundry, Sokolowski stressed the evils of hot sand and the misapplication of coke. He emphasized that the best size of coke for each particular cupola must be determined by trial and error; each cupola is a unit in itself. In general, however, he stated that large size coke will effect faster melting, higher temperatures, higher carbon content, higher oxidation losses, and will require deeper initial and operating beds within the cupola.

Smaller size coke will result in lower temperatures, lower carbon pickups, lower oxidation, and will offer more ease in controlling the height of the operating bed.

Sokolowski noted some means of determining whether the operating bed is rising or falling. A rising bed produces:

- Loss in slag fluidity
- Slag lighter in color
- More wool from slag hole
- More bridging
- Higher metal temperature
- More flame at charging door

A falling bed results in:

- Increase in slag fluidity
- Slag darker in color
- Increased melting rate
- Lower metal temperature
- Greater chilling tendency

Pattern Seminar on Epoxy Resin Use

Identical pattern seminars were held both days of the conference so that all interested persons would have a chance to learn more about epoxy resin as a pattern material. Speakers were W. V. Frid, Tylene Plastics, Inc., Michigan City, Ind. and F. M. Hagquist, Freeman Supply Co., Toledo, Ohio. The two men combined to give a history of the development of plastics in tooling from the early ethyl cellulose to the epoxy-hardener combination.

The curing of modern epoxy resins begins as the resin and hardener are mixed together. An exothermic reaction ensues and the mixture begins to gel. Molding must be accomplished before gelling has occurred. There is reportedly no limit on shelf life before the two elements are combined.

Frid emphasized the importance of adding the right amount of hardener to resin for proper curing. The amount of hardener may vary when working with polyester, but is closely controlled with epoxy. Because the mixture requires 70 F or better to cure, the reaction may be slowed down by placing the substance in a tray of ice water. Also, larger volumes of epoxy-hardener mixtures will cure faster than smaller amounts. A slower set-up may be achieved by splitting large volumes.

A film portrayed patternmaking with epoxy resin and fiber glass.

Results of Sand Study!

A sand clinic, held on both days of the conference, was presented by V. M. Rowell, Harry W. Dietert Co., Detroit. He discussed results of a study indicating superiority of broad distribution steel molding sand to narrow distribution type with cereal or silica flour added.

The broad grain distribution sand exhibited highest density, green compressive strength, green tensile strength, dry compressive strength, hot strength and glazing ability; it was lowest in permeability. The narrow grain distribution with silica flour had highest permeability and lowest density, green compressive and tensile strengths, poorest glazing characteristics, and worst appearance on exposure to thermal shock.

REGIONAL ! !

How to Gate That Casting!

Two talks on gating were presented at the conference. The first, *Principles of Effective Gating*, by J. O. Kura, Battelle Memorial Institute, Columbus, Ohio.

Pressed for time, Kura gave his audience a "nutshell" resume of the physics of effective gating of castings. He said that when gating is mentioned in the average foundry, "everyone is an expert." Although there is usually more than one way to gate a casting effectively, one must first know the principles involved; having learned them, he can rapidly succeed.

There is always turbulent flow, Kura continued, in every gating system. The purpose of gating is to control turbulence so as not to adversely effect castings quality. He stated that every foundryman can learn how to use the formula to determine "Reynold's Number," for a particular gating system, and thus determine the best system for a specific casting.

Kura likened a stream of water falling from a faucet to the stream of molten metal as it enters the sprue of a casting. The stream tapers to a point. Therefore, sprues should be tapered to avoid low pressure areas occasioned by a tapering stream of metal which will not completely fill the sprue. These low pressure areas create turbulence which suck air and mold gases into the metal. This, Kura described as the "law of continuity."

Referring to Newton's law of motion, Kura explained that a particle will continue in the same direction until it meets a force to alter that direction. Applied to gating, this principle results in low pressure areas being created as metal is forced to turn sharp corners. Corners, therefore, should be rounded.

As for use of chokes, in Kura's opinion there is only one place where chokes should be used, at the bottom of the sprue.

Gating the New Alloys, by Joseph Allen, Federal Metals Div., American Smelting & Refining Co., Newark, N. J.

Allen emphasized that gating of newly developed alloys depends upon their composition. Some of the alloys he discussed were Superstone and 90/10 copper nickel (copper alloys) and A356, 357, Tens-50, and X-250 (aluminum alloys). Top gating should not be used, continued Allen, with aluminum, magnesium, aluminum-bronze, and manganese-bronze alloys. The type of gating best suited for these alloys is horizontal gating. This involves a runner in the drag and ingates in the cope, a "little more expensive," but effective.

Allen has found magnesium to be one of the most difficult to cast; the most effective gating system for such alloys has proved to be a horizontal system with screens. A gating system which seems to work in casting aluminum alloys involves placing five or six "slots" in the sprue. This reportedly prevents air and oxides from being sucked down into the well to contaminate the metal.

If possible, the best areas to gate are in non-critical locations and at heavy sections.

Kuivinen Cites Designer Needs

What Does the Designer Expect of the Foundry?, by T. O. Kuivinen, Cooper-Bessemer Corp., Mount Vernon, Ohio.

References to designer-foundrymen relationships in this talk were limited to cast parts for the heavy machinery industry. Kuivinen stated that the designer needs to have assurance that the strength level in the casting will be at the level used during his design computations. Foundrymen need suitable facilities for determining material strength attainable in all types of castings. Each foundry's laboratory must develop means "for determining and correlating casting strength to the values obtained from control test bars."

Experimental work is needed to eliminate shrink and dross. Often the latter can be handled by design alteration so that dross occurs in an area where it is removed by machining.

Designers must consult foundrymen, continued Kuivinen, during the designing stage so that the part is producible as well as functional. There is often more than one way to design a part. "Effective communication between foundryman and designer helps to attain the common objective."

Brown Emphasizes Training

At the banquet meeting, K. A. Digney, Oberdorfer foundries, presented the Honorable Newell Brown, Assistant Secretary of Labor. Brown stated that fe · industries in the United States match the foundry industry in keeping pace with scientific progress. With the projected population figure of this country put at 193 million by 1965, there will be a need for 10 million more persons in the labor force. This will precipitate a need for development of a skilled labor force of 500,000 annually for the next six years for industry as a whole. Three basic needs stand out, Brown continued, for industry to face if it is to keep pace with the exploding world population.

1) Obtain complete information on skills which are now and will be needed in your industry.
2) Organize an efficient training program for new personnel.
3) Develop the skill potential of those already on the job.

Honorable Newell Brown speaks before banquet session. **D. J. Merwin**, general conference chairman, seated.

Brown cited results of two studies in 1956 undertaken by the United States Department of Labor involving mechanized production foundries and jobbing foundries which were non-mechanized. Of the production foundries reporting, 75 per cent planned to increase their employment by an average of 20 per cent during the period 1956-1960. During this same period, jobbing foundries planned an average increase of six per cent; more than one-half specified plans to install mechanized equipment.

According to the studies in 1956, 80 per cent of production foundries and 68 per cent of jobbing foundries were conducting training courses for their personnel. This compares very favorably with the 33 per cent average of industry in general.

Over 280 foundrymen converged on Columbus, Ohio, October 22-23, to participate in the Eighth Ohio Regional Foundry Conference. Conference was sponsored by five AFS Chapters—Central Ohio, Cincinnati, Canton, Northeastern Ohio and Toledo.

The program of 33 speakers was packed with plenty of metalcasting technology for everyone. To satisfy the broad interests of such a large group the program was diversified by conducting as many as five simultaneous sessions at one time.

In appreciation of the considerable time and effort donated by the speakers and their companies, each man on the program received a handsome cast aluminum nameplate plaque.

D. E. Krause, Gray Iron Research Institute, Columbus, Ohio, served as Conference General Chairman. Photographs in this story were taken by J. A. Riley, Jr., Cooper-Bessemer Corp., Mt. Vernon, Ohio.

Besides the technical talks summarized below, luncheon and banquet speakers included Marvin Homan, Asst. Dir. of Athletic Publicity, Ohio State University; Lt. Col. K. W. Hardy, Strategic Air Command, Lockborne Air Base, Columbus, Ohio; and A. B. Sinnett, Secretary, American Foundrymen's Society, Des Plaines.

The Conference was opened by talks from two representatives of Ohio State University . . . H. A. Bolz, Dean of Engineering and M. G. Fontana, Chairman, Dept. of Metallurgical Engineering. The Dean explained that Ohio State engineers were being trained to be: 1) constructively critical, 2) boldly creative, 3) scientifically analytical. Prof. Fontana described the 2-3 University Program. First two years are pre-engineering and last three years are devoted to professional engineering education.

FRANK K. ILLENDA

CHARLES WARD

DAN CHESTER

JOSEPH GILLESPIE

The four speakers shown above comprised a panel discussing APPLICATIONS FOR THE CO_2 PROCESS IN THE FOUNDRY. Panel Chairman **E. H. King,** Hill & Griffith Co., Cincinnati, set the stage by summarizing such areas as cost, handling properties, storage life, shakeout properties, mixing, gassing and applications in aluminum, brass, bronze, gray iron, malleable and steel. Panelists answered a number of questions from the floor about release agents, air drying, dimensional accuracy and binder-metal reactions.

PATTERN SESSIONS

PATTERN DESIGN, by **W. Weaver,** Modern Patterns and Plastics Co., Toledo, Ohio. Plastic pattern equipment is being made by three techniques: 1) room temperature laminated, 2) room temperature surface cast, and 3) high temperature epoxy filled with glass and metal fibers.

PLASTIC PATTERNS, by **M. K. Young,** U. S. Gypsum Co., Chicago. The speaker showed a new color film covering all construction details for plastic pattern-making. Several interesting innovations included the use of a squeegee for applying plastic over large areas of fiberglass cloth and casting bolts into back of patterns for mounting as a matchplate.

MALLEABLE SESSIONS

THE FOUNDRY SUPERVISOR'S VIEWPOINT OF MOLDING SAND AND ITS CONTROL, by **G. Medley,** Webster Mfg., Inc., Tiffin, Ohio. Water can be source of much trouble in sand mixes. Often best to run sand drier than molders like it. Sand mix needs at least 5 per cent fines to help distribute clay. For casting dimensional accuracy molds should have 80-90 hardness. Mulling capacity can be reduced drastically by using facing sand and backing up with sand run through a cutter. Although molding sand represents only one-half per cent of total casting cost, it does cause about 30 per cent of the scrap.

SOLIDIFICATION AND FEEDING OF MALLEABLE IRON, by **B. C. Yearly,** National Malleable and Steel Castings Co., Cleveland. Both malleable iron and steel are skin-forming metals. But malleable shrinks 4.5 per cent in volume when solidifying compared to 3 per cent for steel. By properly controlling the rate of heat removal from the solidifying metal, every part of the casting, as it freezes, will be connected to liquid feed metal.

STEEL SESSIONS

NEW DEVELOPMENTS: PROGRESS IN ELECTRIC FURNACE MELTING AND LADLE PRACTICE, by **J. Hathaway,** Massilon Steel Castings Co., Massillon, Ohio. Speaker described a closed circuit TV system used to monitor electric power consumption. An oxygen lance is used to boil 6 to 8 points of carbon out of the metal per minute. Platinum-irridium thermocouples are used. Furnace bottom life is 10 or more years.

HOT TEARS IN STEEL CASTINGS, by **J. A. Rassenfoss,** American Steel Foundries, East Chicago, Ind. Hot tears are interdendritic ruptures occurring at hot spots which concentrate contraction take up space needed for "are" in this line strains. Hot tears can be minimized by: 1) pouring at lower temperature, 2) lowering sulfur content, 3) lowering manganese content 4) keeping carbon level above or below critical value of 0.25 per cent, 5) eliminating tin content.

METALLURGY OF CAST STEEL, by **C. K. Donoho,** American Cast Iron Pipe Co., Birmingham, Ala. Blind risers function best as soon as a solid envelop of metal surrounds steel casting. Heat treatment is only means available for refining cast grain structure. Steels are hardened by additions of Cr, Mn, Mo, Ni, V and B. High temperature strength comes from Cr and Mo. Corrosion resistance is imparted by Cr and Ni. Steel deoxidizers include Al, Si, Ti, Zr, Ca, and Mg.

STEEL SAND, by **G. Vingas,** Magnet Cove Barium Corp., Arlington Heights, Ill. Cereal protects sand mixes from rapid water evaporation or excess drying during storage as well as from overmulling. Silica flour is added to close voids in sand but in doing so it destroys some of the clay bonding action, plasticity and rammability. Iron oxide stops veining and provides a fluxing action.

GRAY IRON SESSIONS

RISERING OF GRAY AND DUCTILE IRON, by **J. F. Wallace,** Case Institute of Technology, Cleveland. Solidification shrinkage is greatly reduced if mold walls are rigid. Riserless castings are often possible if molds are strong enough to resist wall movement. Maximum carbon and silicon minimize volumetric changes during solidification so sound castings are more feasible. Sound castings can be achieved by feeding sections that solidify last or by gating into thin sections to establish uniform temperature gradients.

INOCULATION – CONTROL TOOL FOR ACID AND BASIC CUPOLA MELTING, by **A. P. Alexander,** International Harvester Co., Memphis, Tenn. Inoculation involves the addition of a graphitizing element to molten iron so that the structure is refined and strength raised. The effect of inoculation wears off with time so it should be done late when pouring into the transfer ladle. Inoculation is also required to refine iron produced in a basic cupola operation.

MANUFACTURING PROCEDURE AND ECONOMICS USING COLD SET BOND, by **F. Dettore,** G. E. Smith Co., Pittsburgh, Pa. Both silica and zircon sand are suited to the cold-set process. Set time is controlled by amount of additive, mulling time and sand temperature. Because core boxes are tied up while core hardens, careful scheduling is required. Economies result from: 1) elimination of dryers, 2) reduction in rodding, 3) use of one-piece boxes, and 4) shortened baking periods. To avoid sand sticking, patterns and boxes should be coated with lacquer rather than shellac.

OPERATION OF WATER-COOLED CUPOLAS, by **M. H. Horton,** Deere & Co., Moline, Ill. Cupolas may be cooled with outside sprays and internal or external water tanks. Water cooling has led to larger tonnages, lower operating costs and longer operating periods. Cupola may be operated 8 hours, banked 16 hours and bottom dropped every 5 days. Pig iron has been eliminated entirely from basic operations.

NON-FERROUS SESSIONS

EXPERIENCES IN MELTING BRASS BY INDUCTION, INDIRECT ARC AND CRUCIBLE METHODS, by **A. W. Bardeen** and **W. J. Amsbary,** Ohio Brass Co., Mansfield, Ohio. Thirty-five years of melting experiences by three techniques were reviewed on the basis of raw materials, melting characteristics and costs. Low frequency induction melting is best for high zinc brasses, yields most foolproof metal, but requires most operating skill. Indirect arc furnace is fast melting, capable of high temperatures and noisy in operation. Crucible furnaces are slow melting but most flexible.

PERMANENT MOLDING ALUMINUM ALLOYS, by **P. Petto, Jr.** and **R. Seher,** Arrow Aluminum Castings Co., Cleveland. Petto spelled out the advantages of permanent-mold castings as: better appearance, greater accuracy, higher physical properties, possible weight-saving, less machining stock and lower price. Undercuts can be cast by using collapsible steel cores or sand cores. Seher described permanent-mold practices in a number of European foundries he visited.

METALLURGY OF ALUMINUM AND MAGNESIUM, by **E. E. Stonebrook,** Aluminum Co. of America, Cleveland. Fluidity is increased as the degrees of superheat above the alloy's liquidus increase. The more eutectic material formed during solidification the higher will be the alloy's fluidity. Alloys feed well that have a relatively small solidification range. All solid solution type alloys which form no eutectic during solidification have relatively poor feeding characteristics. Eutectic material also improves an alloy's cracking resistance.

GATING AND RISERING COPPER-BASE ALLOYS, by **W. Ball, Jr.,** R. Lavin & Sons, Chicago. Each alloy has its own characteristics as far as gating and risering are concerned. For proper gating one must know: 1) ability of alloy to flow and feed, 2) degree of venting necessary, 3) design of casting, and 4) fluxes and their effects. Solidification rate is dependent on ratio of casting volume to its surface. Directional solidification involves proper use of gates, risers and chills to achieve sound castings.

OTHER TECHNICAL SESSIONS

A SOUND MAINTENANCE SYSTEM PAYS OFF, by **R. Smith,** Unitcast Corp., Toledo, Ohio. A spare parts store is needed to take care of emergencies. But wherever possible parts should be standardized to cut down on inventory requirements. When possible, parts should be sub-assembled into units for easy replacement. The damaged unit can then be repaired when convenient without delaying operations. A card record system with minimum detail and maximum information is a vital cog in the program.

CLEANING OF CASTINGS, by **E. F. Price,** Dayton Malleable Iron Co., Dayton, Ohio. Holding down cleaning costs starts with good pattern equipment that prevents finning. Improved gating can make cleaning easier with less grinding.

SHELL MOLDS AND CORES PANEL DISCUSSION, by **B. D. Claffey,** GHR Foundry Div., Dayton Malleable Iron Co., Dayton, Ohio, **L. E. Wile,** Lynchburg Foundry Co., Lynchburg, Va., and **J. W. Gillespie,** Ohio Steel Foundry Co., Springfield, Ohio. Gillespie cited his experiences with converting austenitic steel work from green sand to shell molds. Satisfactory surface finish has not yet been obtained on ferritic steel. Wile enumerated a number of shell core advantages, such as: less sand needed; smaller core prints; elimination of rods, wires, dryers and ovens; and reduced venting, hot cracking, blows and scabs. Claffey reviewed some reasons for using shell molding but also pointed out the following disadvantages: high cost of equipment, patterns and maintenance; increased casting cost and scrap losses.

1960 Foundry Exposition Previews

■ A tremendous future awaits the foundry industry. This is the theme of the AFS-sponsored Regional Foundry Conferences presented coast-to-coast this fall. Speakers representing all phases of the foundry industry predict that a new era will open in the 60's.

These rosy forecasts are tempered by the feeling that the industry must do a better job of selling its customers and be willing and able to adopt new technological advances.

New processes, new metals and new standards must be adopted, say the speakers, for the next decade looks as bright for the casting competitors as for the foundries themselves. The era of increased production will be accompanied by even more aggressive competition, from within as well as outside of the industry.

In six months, May 9-13, the AFS '60 Exposition at Philadelphia will demonstrate the greatest display of equipment and supplies in the history of the industry. Manufacturers and suppliers will turn heavily to operating exhibits to tell their story.

Two complete operating foundries will be on display . . . one ferrous and the other non-ferrous. Additional operating exhibits will demonstrate the latest in permanent molding and die casting, patternmaking, materials handling, air pollution control, cleaning operations and other facets of foundry operations.

To date more than 125 exhibitors have applied for space in this 1960 Castings Industry Showplace. Applications for space are running ahead of the 1958 Foundry Show in Cleveland. However, due to the size of the Philadelphia Trade & Convention Hall, considerable prime floor space is still available. Exhibit Manager W. N. Davis cautions exhibitors to make early applications for space, since assignments are made on a first come, first serve basis.

The '60 Exposition will provide foundrymen, equipment manufacturers and suppliers an opportunity to preview their product progress before a record audience of progressive foundrymen including a large number of foreign visitors.

Exhibitors as of Oct. 27.

Acme Resin Corp., Forest Park, Ill.
The Adams Co., Dubuque, Iowa
A. I. C. Engineering Co., Inc., Indianapolis
Ajax Magnethermic Corp., Youngstown, Ohio
Alloy Metal Abrasive Co., Ann Arbor, Mich.
Alloy Metal Products, Inc., Davenport, Iowa
American Air Filter Co., Inc., Louisville, Ky.
American Colloid Co., Skokie, Ill.
American Foundry Flask Co., Kansas City, Mo.
American Metal Market Co., New York
American Refractories & Crucible Corp., North Haven, Conn.
American Smelting & Refining Co., New York
Apex Smelting Co., Chicago
Arcair Co., Lancaster, Ohio
Archer-Daniels-Midland Co., Cleveland
C. O. Bartlett-Snow Co., Cleveland
Baroid Chemicals, Inc., Houston, Texas
Beardsley & Piper Div., Pettibone Mulliken Corp., Chicago
Blastcrete Service Co., Los Angeles
British Moulding Machine Co. Ltd., Faversham, Kent, England
Brown Thermal Products Corp., Elyria, Ohio
Brush Beryllium Co., Cleveland
C & S. Products Co., Detroit
Campbell-Hausfeld Co., Harrison, Ohio
Carborundum Co., Niagara Falls, N. Y.
Cardox Div. of Chemetron Corp., Chicago
Carrier Conveyor Corp., Louisville, Ky.
Carver Foundry Products, Muscatine, Iowa
Centrifugal Casting Machine Co., Tulsa, Okla.
Clearfield Machine Co., Clearfield, Pa.
Cleveland Flux Co., Cleveland
Davenport Machine & Foundry Co., Davenport, Iowa
Davey Compressor Co., Kent, Ohio
Davis Fire Brick Co., Columbus, Ohio
Debevoise-Anderson Co., Philadelphia
Delta Oil Products Corp., Milwaukee.
Demmler Mfg. Co., Kewanee, Ill.
Dependable Shell Core Machines, Inc., Portland, Ore.
Harry W. Dietert Co., Detroit
Dike-O-Seal, Inc., Chicago
Joseph Dixon Crucible Co., Jersey City, N. J.
Durez Plastics Div., Hooker Electrochemical Co., N. Tonawanda, N. Y.
Electro Refractories & Abrasives Corp., Lackawanna, N. Y.
Encyclopaedia Britannica, Philadelphia
Exomet, Inc., Conneaut, Ohio
Fanner Mfg. Co., Cleveland
Foundry, Cleveland
Foundry Equipment Co., Cleveland
Foundry Services, Inc., Cleveland
Fox Grinders, Inc., Pittsburgh, Pa.
Fremont Flask Co., Fremont, Ohio
General Dynamics Corp., Chicago
General Refractories Co., Philadelphia
Great Lakes Carbon Corp., New York
Great Lakes Foundry Sand Co., Detroit
Harbison-Walker Refractories Co., Pittsburgh, Pa.
Herman Pneumatic Machine Co., Pittsburgh, Pa.
Hevi-Duty Electric Co., Milwaukee
Hickman, Williams & Co., Philadelphia
Hill & Griffith Co., Cincinnati
The Frank G. Hough Co., Libertyville, Ill.
E. F. Houghton & Co., Philadelphia
Houghton Laboratories, Inc., Olean, N. Y.
Indianapolis Wire Bound Box Co., Fernwood, Miss.
Inductotherm Corp., Delanco, N. J.
International Nickel Co., Inc., New York
Iron Lung Ventilator Co., Cleveland
Jeffrey Mfg. Co., Columbus, Ohio
King Tester Corp., Philadelphia
Lester B. Knight & Associates, Inc., Chicago
H. Kramer & Co., Chicago
Kuhlman Electric Co., Detroit Electric Furnace Div., Bay City, Mich.
Laboratory Equipment Corp., St. Joseph, Mich.
Lava Crucible Refractories Co., Pittsburgh, Pa.
R. Lavin & Sons, Chicago

Equipment and Processes of Future

Lectromelt Furnace Div., McGraw Edison Co., Pittsburgh, Pa.
Link-Belt Co., Chicago
Magnaflux Corp., Chicago
Main Brothers Box & Lumber Co., Karnak, Ill.
Manley Sand Co., Rockton, Ill.
Martin Engineering Co., Neponset, Ill.
Master Power Corp., Bedford, Ohio
Mexico Refractories Co., Mexico, Mo.
Minerals & Chemicals Corp. of America, Menlo, N. J.
Mine Safety Appliances Co., Pittsburgh, Pa.
Jesse S. Morie & Son, Inc., Vineland, N. J.
The Moulders' Friend, Dallas City, Ill.
National Crucible Co., Philadelphia
National Engineering Co., Chicago
National Pigment Co., Inc., Philadelphia
Newaygo Engineering Co., Newaygo, Mich.
New Jersey Silica Sand Co., Millville, N. J.
North American Smelting Co., Wilmington, Dela.
S. Obermayer Co., Chicago
Ohio Ferro Alloys Corp., Canton, Ohio
Orefraction Minerals, Andrews, S. C.
Osborn Mfg. Co., Cleveland
Pangborn Corp., Hagerstown, Md.
Penn-Rillton Co., New York
Pennsylvania Foundry Supply & Sand Co., Philadelphia
Pennsylvania Glass Sand Corp., New York
Penola Oil Co., Detroit
Geo. F. Pettinos, Inc., Philadelphia
Philips Electronics, Inc., Mt. Vernon, N. Y.
Picker-X-Ray Corp., White Plains, N. Y.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Planet Corp., Lansing, Mich.
Pressure Match Plate Co., Inc., Philadelphia
Pure Carbonic Co., Div. of Air Reduction Co. Inc., New York
Pyrometer Instrument Co., Inc., Bergenfield, N. J.
Redford Iron & Equipment Co., Detroit
Roessing Bronze Co., Pittsburgh, Pa.
Ross-Tacony Crucible Co., Philadelphia
Royer Foundry & Machine Co., Kingston, Pa.
George Sall Metals Co., Inc., Philadelphia
Claude B. Schneible Co., Detroit
Semet Solvay Div., Allied Chemical Corp., New York
Shalco Corp., Palo Alto, Calif.
Simplicity Engineering Co., Durand, Mich.
Sipi Metals Corp., Chicago
G. E. Smith, Inc., Pittsburgh, Pa.
Speer Carbon Co., St. Mary's, Pa.
SPO, Inc., Cleveland
Stahl Specialty Co., Kingsville, Mo.
Standard Electrical Tool Co., Cincinnati
Standard Horse Nail Corp., New Brighton, Pa.
Stearns Magnetic Products, Milwaukee
Sterling National Industries, Inc., Milwaukee
Frederic B. Stevens, Inc., Detroit
Sutter Products Co., Holly, Mich.
Thor Power Tool Co., Aurora, Ill.
Toledo Scale, Div. of Toledo Scale Corp., Toledo, Ohio
Union Carbide Corp., New York
United Oil Mfg. Co., Erie, Pa.
United States Gypsum Co., Chicago
Vesuvius Crucible Co., Pittsburgh, Pa.
Wheelabrator Corp., Mishawaka, Ind.
Whirl-Air-Flow, Minneapolis
Whitehead Brothers Co., New York
Yale & Towne Mfg. Co., Philadelphia

AFS-T&RI Course Outlines Steps for Maintenance Plan

■ Installation and operation of a foundry maintenance program was explained by nine experts at the AFS-T&RI *Preventive Maintenance* course given Oct. 26-28 at the Hamilton Hotel, Chicago.

Organizing and controlling the program was explained by K. M. Smith, Caterpillar Tractor Co., Peoria, Ill., who enumerated the basic steps as; a maintenance analysis of plant equipment, inspections, spare parts, records and forms, accounting, organizational of department and personnel and selling the program to management.

Specific equipment maintenance programs were divided into seven divisions.

A. D. Oldham and W. R. Jaeschke, Whiting Corp., Harvey, Ill., spoke on melting equipment covering charging equipment, drop bottom and supports, blowers and controls, arc furnaces and pouring equipment.

H. G. Greiner, Whiting Corp., discussed lifting equipment with recommendations on cranes, hoists, hooks, chains and wire rope, gears, drives and brakes and crane runways and power contacts.

William D. Lee., General Electric Co., Schenectady, N. Y., told foundrymen how to get the most from their electrical and control equipment with motors, spares, lubrication breakdowns, planned overhaul and repair, record forms, scheduling, steps for productive maintenance and conclusions and recommendations.

George Koren, Beardsley & Piper Div., Pettibone Mulliken Corp., Chicago, provided steps for molding and core machine maintenance which included jolt-squeeze and roll-over, slinger, shell molding machines, core blowers, controls, lubrication, inspection, scheduling repairs, records and replacement.

S. A. Simonson, Chicago Hardware Foundry Co., North Chicago, Ill., advanced recommendations for materials handing and physical plant equipment including trucks and unloading equipment, conveyors, bucket elevators, shakeouts and screens, eccentrics, lubrication, cleaning and painting, cleaning room equipment, housekeeping, building maintenance and sand conditioning equipment.

H. J. Weber, AFS Director of Safety, Hygiene and Air Pollution Control Program discussed safety-maintenance relationship, dust collectors and fans and blowers. T&RI Training Supervisor R. E. Betterley conducted an achievement test.

Harry Deopp, Jr., Schramm, Inc., discusses compressed air systems in AFS-T&RI preventive maintenance course.

Grassby Heads Committee on Publicity, Membership

■ W. J. Grassby, Bendix Products Div., Bendix Aviation Corp., South Bend, Ind., heads the Membership and Publicity Committee of the Die Casting & Permanent Mold Division.

Other members are: W. N. Brammer, Pressure Castings, Inc., Cleveland; D. L. Colwell, Apex Smelting Co., Cleveland; H. Rosenson, R. Lavin & Sons, Chicago; J. Schmidt, Lester Phoenix, Inc., Chicago; E. R. Wiehl, Federated Metals Div., American Smelting & Refining Co., Los Angeles.

Members of the **Light Metals Executive Division** relaxing at meeting held in September at Massachusetts Institute of Technology, Cambridge, Mass. Left to right: **Samuel Lipson,** Pitman-Dunn Frankford, Arsenal, Philadelphia; **Prof. M. C. Flemings, Jr.,** M.I.T.; **John Mezoff,** Dow Chemical Co., Midland, Mich.; **George Found,** Arthur D. Little, Inc., Cambridge, Mass. **Ernest Poirier,** M.I.T. student; **S. C. Massari,** AFS Technical Director; **Walter Sicha,** Aluminum Co. of America, Cleveland; **Donald LaVelle,** Federated Metals Div., American Smelting & Refining Co., South Plainfield, N.Y.; **Ralph Edelman,** Pitman-Dunn Laboratories, Frankford Arsenal, Philadelphia.

Malleable Division Research Committee met at University of Wisconsin to review progress reports on current research projects and to map future activities. Seated are: **Eric Welander,** John Deere Malleable Works; **James Lansing,** Ductile Iron Society; **C. F. Joseph,** Central Foundry Div., General Motors Corp.; **E. J. Stockum,** Dayton Malleable Iron Co. Standing: **R. P. Schauss,** Werner G. Smith, Inc.; **R E. Betterley,** AFS Education Directors; **R. W. Heine,** University of Wisconsin; **P. F. Ulmer,** Link-Belt Co.; **G. B. Mannweiler,** Eastern Malleable Iron Co.; **C. R. Loper, Jr.,** University of Wisconsin.

Committee 8-N — J. G. Smillie, John Deere & Co.; **J. A. Terpenning,** Archer-Daniels-Midland Co.; **G. M. Etherington,** American Brake Shoe Co.; **R. A. Rabe,** General Motors Corp.; **F. W. Less,** Durez Plastics & Chemicals, Inc.; **J. F. Haskins,** Monsanto Chemical Co.; **H. J. Weber,** AFS Assistant Technical Director; **R. E. Daine,** Aluminum Co. of America; **J. J. Curran,** Pennsylvania Glass Sand Corp., alternate for G. I. Reynolds.

Committee 8-R — D. S. Dalton, Thiem Products Inc.; **W. R. McDonnough,** Magnet Cove Barium Corp., alternate for A. H. Zrimsek; **H. J. Weber,** AFS Assistant Technical Director; **L. Winnings,** Wagner Castings; **C. Bendig,** Erie Malleable Iron Co.; **R. H. Brookes,** Link-Belt Co.

Sand Division Maps Convention Program

■ Five technical sessions, a sand shop course and a Sand Division Dinner were tentatively scheduled for the 1960 Convention by the Sand Division Executive Committee meeting in Chicago. Efforts are being made to obtain a foreign speaker for the dinner.

A committee was appointed to write a procedures book defining duties of new chairmen. The group headed by former chairman E. C. Zirzow, Werner G. Smith, Inc., Cleveland, includes J. B. Caine, consultant, Cincinnati; C. A. Sanders, American Colloid Co., Skokie, Ill.; O. J. Myers, Reichhold Chemicals, Inc., White Plains, N. Y.; V. M. Rowell, Harry W. Dietert Co., Detroit; and T. W. Seaton, American Silica Sand Co., Ottawa, Ill.

SHELL MOLD COMMITTEE—Presented the proposed tentative standard procedures for the determination of:

- Melt point.
- Hot shell tensile strength.
- Hot shell deflection.
- Shell transverse strength.
- Shell permeability.

These proposed tentative standards were accepted, with minor changes, by the executive committee. These tentative standards will appear in the new SAND TESTING HANDBOOK.

CORE TEST COMMITTEE—Working on tentative standards for testing oxygen-air setting binders and CO_2 binders. It is requested that if any members uses or knows of a test for evaluating these binders that they be submitted for the committee for review.

BASIC CONCEPTS COMMITTEE—Working on a tentative standard for density measurements. The tentative standard will be presented at the next meeting of the Executive Committee. The test is considered particularly important since it ties in closely with many casting defects.

MALLEABLE SAND COMMITTEE—Studying pinhole porosity and preparing a questionnaire to be sent to all malleable foundries.

GRADING & FINENESS COMMITTEE—Working on a number of projects including sampling techniques, segregation and the determination of clay substance of sands containing seacoal and suppressing materials.

Work is also progressing on three books, MOLDING METHODS AND MATERIALS, CASTING QUALITY AND SAND TESTING HANDBOOK.

AFS Releases Education Film

■ Vital but unrecognized contributions of castings to everyday living are explained in a new AFS film "Casting Metals and You." It is designed for general use such as Chapter education nights, Career Carnivals, PTA programs, secondary school guidance programs and civic organizations meetings.

The film, developed by the AFS Education Division, deals with the scope and application of castings from the home to every phase of industry. It also stresses foundry training, educational methods, facilities and career opportunities in the castings field.

The 16 mm film with sound and color has a 26-min running time.

Beardsley & Piper, Div. Pettibone Mulliken Corp., Chicago, donated the silent film with the Society financing its production and sound track. I. H. Dennen, Chairman, Beardsley & Piper, supervised the film production and narrated the sound track. Before final adoption, the film was evaluated and revised by a committee composed of Dennen, A. C. Smith, American Steel Foundries; R. A. Oster, Beloit Adult & Vocational School; R. W. Schroeder, University of Illinois, Navy Pier Branch, and R. E. Betterley, AFS Education Director.

No charge will be made for the film to educational institutions and civic groups. A fee of $10 will be charged to AFS Chapters and other organizations. In all cases, the films will be shipped express collect and must be returned express pre-paid. It may be ordered from the AFS film library, AFS Headquarters, Golf & Wolf Roads, Des Plaines, Ill.

Name J. B. Caine as 1961 Hoyt Lecturer

■ John B. Caine, foundry consultant of Cincinnati, has been named as the 1961 Charles Edgar Hoyt Lecturer. In 1955 he was awarded the AFS Whiting Gold Medal . . . "For outstanding contributions to the Society and industry, particularly in the field of foundry sand research and applications."

Caine for many years has been active in AFS technical activities, serving as a member and chairman of various committees in the Sand and Steel Divisions as well as the Heat Transfer Committee. Currently he is a member of five Sand Division Committees and two in the Steel Division.

Committee 6-E—R. J. Franck, Superior Steel & Malleable Castings Co.; **J. L. Flitz,** Central Foundry Div., General Motors Corp.; **C. R. Baker,** Albion Malleable Iron Co.; **J. W. Beckham,** Texas Foundries, Inc.; **H. J. Weber,** AFS Assistant Technical Director; **H. J. Heine,** Malleable Founders' Society; **R. A. Johns,** Belle City Malleable Iron Co.

Committee 10-F—H. J. Weber, AFS Assistant Technical Director; **L. W. Lehmann,** John Deere Horicon Works; **M. T. Sell,** Sterling Foundry Co.; **W. E. Boswell,** Glamorgan Pipe & Foundry Co.; **A. G. McNichol,** Canada Iron Foundries, Ltd.; **J. A. Westover,** Westover Corp. & Associates.

Committee 8-C—S. A. Yount, Pittsburgh Plate Glass Co.; **C. E. Schubert,** University of Illinois; **Victor E. Zang,** Unitcast Corp.; **V. M. Rowell,** Harry W. Dietert Co.; **D. R. Chester,** Archer-Daniels-Midland Co.; **H. J. Weber,** AFS Assistant Technical Director; **W H. Buell,** Aristo Corp.; **C. J. Jelinek,** Cleveland Foundry, Ford Motor Co.

Committee 8-J — T. E. Barlow, Eastern Clay Products Dept., International Minerals & Chemical Corp.; **W. A. Hambley,** Chas. A. Krause Milling Co.; **E. J. Passman,** Frederic B. Stevens, Inc.; **H. W. Dietert,** Harry W. Dietert Co.; **R. L. Doelman,** Miller & Co.; **Burdette Jones,** John Deere, Waterloo Tractor Works; **L. E. Taylor,** Ottawa Silica Co.; **W. E. Randquist,** Walter Gerlinger, Inc.; **J. C. Dixon,** Cities Service Oil Co.; **C. L. Bowman,** Golden Foundry Co., Columbus, Md.; **C. R. Loper,** University of Wisconsin; **E. N. Reusser,** Ford Motor Co.; **A. J. Weber,** AFS Assistant Technical Director; **V. M. Rowell,** Harry W. Dietert Co.

26th International Congress

■ The 26th International Foundry Congress and the Fourth General Meeting of the Instituto del Hierro y del Acero was held in Madrid, Spain, in the Delegacion National de Sidicatos, Oct. 5-10. Formal opening of the Congress was presided over by Dr. A. Dacco of Italy and an address of welcome was presented by the Minister of Industry of Spain. Approximately 1400 foundrymen attended the International Congress and in most instances, with their ladies.

Over-all organization of the Congress was extremely good and a great deal of credit was due our Spanish host and, particularly to Agustin Plana, President of the Organizing Committee, and Jose Andres, General Secretary.

Several tours were arranged for the visiting foundrymen as well as for the ladies, including a visit to the large new Truck & Motor Coach plant of the Impresa Nacional de Autocamiones. In the latter instance, it also included a visit through the foundry in the same plant.

Technical sessions were scheduled each day from Wednesday through Saturday. H. H. Wilder of the Vanadium Corp. of America, presented the Official Exchange Paper from the American Foundrymen's Society to the Congress, on the subject of "Ferro Alloys & Inoculants for the Production of High-Strength Gray Cast Iron."

A visit was also arranged for all guests to the Grand Opening of the Instituto del Hierro y del Acero, the new school of metallurgy at the University of Madrid. The school of metallurgy is housed in a very finely constructed building, and includes a broad variety of equipment to serve all phases of metal research.

Mario Olivo, Chairman of the International Dictionary Committee, reporting on behalf of the committee, advised that some 2200 terms will be defined in the dictionary. It is hoped that the dictionary will be completed and published sometime in 1960 and will be available at an approximate cost of $8 per copy. It will be published in all of the official languages of the International Committee.

With regret the resignation of George Lambert as Secretary of the International Committee was accepted, and a new paid Secretary was appointed—Dr. P. W. Muller of Zurich, Switzerland will serve as the new Secretary.

by S. C. MASSARI
AFS Technical Director

At the closing official meeting of the International Committee, incumbent Vice-President F. W. Spies, (Netherlands) was officially elected as President for the coming year, and H. E. A. Plana of Spain, as the new Vice-President. M. Vuilleumier of Zurich, Switzerland, was elected as Treasurer for the International Committee.

It was announced that the International Foundry Congress will be held in Zurich, Switzerland in 1960, Vienna in 1961, United States (Detroit) in 1962, and the Prague in 1963. Invitations were received from the delegates from Yugoslavia and Poland to have the International in those countries in 1964 and 1965 respectively. The decision on these invitations was deferred.

AFS Technical Director **S. C. Massari** presiding at technical session. Massari also represented AFS at the various committee meetings.

Dr. A. B. Everest (Great Britain) and wife. Dr. Everest is Treasurer of the International Committee of Foundry Technical Associations and representative of AFS on the International Committee.

Attending from the United States, second row, are **A. L. Fischer,** Fischer Casting Co., Dunellen, N. J.: **Howard H. Wilder,** author of the official AFS Exchange Paper; **Mrs. Wilder** and **Mrs. S. C. Massari.**

Dr. A. Dacco (Italy) president of International Committee of Foundry Technical Associations, speaking. Third from left is **H. E. Agustin Plana Sancho,** president of the organizing committee, 26th International Foundry Congress. Second from right is **George Lambert** (Great Britain) Secretary of I.C.F.T.A. On extreme right is **Jose A. Andres Jimenez,** General secretary of the International Congress.

New headquarters and research facilities of **Spanish Institute of Iron and Steel, dedicated** during the International.

Chapter Chairmen-1959-60

N. D. Amundsen
Terminal City Iron Works, Ltd.
Vancouver, B. C.
Chairman
British Columbia Chapter

W. E. Boyd
Mexico Refractories Div. Kaiser Aluminum & Chemical Sales, Inc.
Indianapolis
Chairman
Central Indiana Chapter

D. C. Caudron
Pacific Brass Foundry of San Francisco
San Francisco
Chairman
Northern California Chapter

J. D. Claffey
Non-Ferrous Casting Co.
Dayton, Ohio
Chairman
Cincinnati Chapter

W. C. Eccles
Cooper-Bessemer Corp.
Grove City, Pa.
Chairman
Northwestern Pennsylvania Chapter

E. G. Gaskell
Ace Foundry Ltd.
Huntington Park, Calif.
Chairman
Southern California Chapter

R. E. Hull
Casting Service Corp.
LaPorte, Ind.
Chairman
Michiana Chapter

Wm. Pitts
Oklahoma Steel Castings Co.
Tulsa, Okla.
Chairman
Tri-State Chapter

Central New York Chapter Board of Directors meeting, left to right: W. C. Dunn, B. R. Artz, P. Benevento, C. W. Diehl, W. W. Thomas, R. T. Thurston, J. Otvos, J. T. Coggin, D. C. Brainard, L. P. Hylton, D. C. Carter, J. C. Ryan, E. H. Fiesinger, R. F. Shea.

G. O. Pfaff, Wheelabrator Corp., center, told Central Illinois members how to reduce blast cleaning costs. Others are Chapter Chairman **J. F. Kauzlarich** and technical chairman **Maurice Elwood.**

—**Charles Bavis**

Former **Philadelphia Chapter** Chairman **J. Robb,** Pennsylvania Foundry Supply & Sand Co., on left, presents chapter's gift to **T. R. Walker,** U. S. Pipe & Foundry Co., Burlington, N. J., in appreciation of services as 1958-59 chairman.

—**Leo Houser, E. C. Klank**

chapter news

Attending the **Pittsburgh Chapter** September meeting were Chapter President **J. D. Wilson,** Bronze Die Casting Co.; immediate Past President **I. W. Sharp,** Walworth Co.; Director **A. M. Cadman,** A. W. Cadman Mfg. Co.; **W. E. Mason,** Westinghouse Air Brake Co. —**Walter Napp**

Frank G. Steinebach, Penton Publishing Co., third from left, addressed the **Pittsburgh Chapter** in September on "What About the Future." Others are Chapter Past President **E. J. Biller,** Vulcan Mold & Machine Co.; Secretary-Treasurer **E. P. Buchanan,** Pittsburgh Coke & Chemical Co. and Vice-President **W. D. Hacker,** Mesta Machine Co. —**Walter Napp**

Northwestern Pennsylvania Chapter

Presents AFS Books to Library

■ AFS publications on various phases of the foundry field, valued at $150 have been presented by the Northwestern Pennsylvania Chapter to the Greenville Public Library.

Presentation of the books with other publications dealing with foundry operations was made by W. S. Hodge, W. S. Hodge Foundry, Inc., Greenville, Pa., former chapter president and member of the library's board of directors.—*Harold Buchanan*

W. S. Hodge, Hodge Foundry, Inc., (right) presents collection of foundry books to **Dr. Roy H. Johnson,** chairman of the Greenville, Pa., public library board of directors.

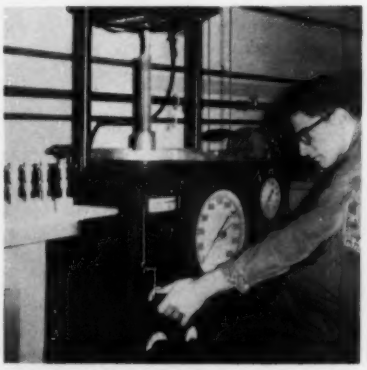
Northwestern Pennsylvania immediate Past President, **W. S. Hodge,** W. S. Hodge Foundry, receives past president's ring from past President **W. R. Ferguson,** Pickands Mather & Co.

Northwestern Pennsylvania Chapter members in September heard **Wayne Buell,** Aristo Corp., Detroit, Mich., shown on left, speak on evaluation and quality control of core oils. On right is Chapter Vice-Chairman **W. J. Miller,** Frederic B. Stevens, Inc. —**Walter Napp**

Foundries in New England Offer Student Employment

■ Summer employment by New England foundries for members of the Wentworth Student Chapter has added the chapter in developing and modernizing its foundry program. In addition to providing on-the-job experience, it also provides students with an opportunity to finance their education.

Summer employment arrangements were made by Alex Beck, Whitman Foundry, Inc., Whitman, Mass.; V. B. Utzinger, Walworth Co., Boston and Lewis Greenslade, Brown & Sharpe Mfg. Co., Providence, R. I., all New England Chapter members.



Wentworth student Don Pesce, makes compression test of molding sand at Walworth Co. as part of summer job.

Student **Richard Forbes** and **Alex Beck,** Whitman Foundry, Inc., discuss new pattern coming to the foundry.

New England Chapter

Tour Includes Seven Foundries

■ More than 200 foundrymen visited seven foundries in southeastern Massachusetts as the September chapter activity.

Foundries co-operating were: Belcher Malleable Iron Co., Easton, malleable iron producer; D. W. Clark & Co., East Bridgewater, medium-sized bronze and copper castings; Bridgewater Foundry Co., Bridgewater, light, medium and heavy gray iron castings; Kingston Aluminum Foundry, Kingston, bronze and aluminum producer; E. L. LeBaron Foundry Co., Brockton, construction specialty castings; Henry Perkins Co., Bridgewater, meehanite castings; Whitman Foundry, Inc., gray iron producer.

—F. S. Holway

Whitman Foundry, Inc., was one of seven foundries visited by **New England Chapter** members in September.

New England Chapter members visiting E. L. LeBaron Foundry Co. **—J. H. Orrok**

Bridgewater Foundry Co., gray iron producer, was one of foundries toured by **New England Chapter.**

Central Michigan Chapter

Shell Cores & Shell Molding

■ Basic knowledge of the shell process was presented at the October meeting by Al Doerr, Midwest Foundries, Coldwater, Mich., who also evaluated the process and displayed typical work done at Midwest during the eight years Midwest has used the process.

Bill Bopp, also of Midwest, told of his experiences with shell cores.

C. R. Baker, Albion Malleable Iron Co., Albion, Mich., reviewed statistical studies on dimensional control in shell castings. Baker's results indicated that each job must be studied individually despite similarity to others. He recommended making patterns oversize so that removal of stock to reach desired dimensions would be possible.—*Melvin Devers*

Cincinnati Chapter

Study Vertical Gating Design

■ Vertical gating design was discussed at the October meeting. An AFS film made at Battelle Memorial Institute showed the fluid flow of metal through vertical gating systems.

A panel discussion was also conducted with R. Ken Guise, Kuhn's Bros. Foundry as moderator. Panelists were Merrick F. McCarthy, Jr., Black-Clawson Co.; Karl G. Presser, Buckeye Foundry Co.; George E. Schultz, Reliable Castings Corp.; Conrad Tobergte, Wm. Powell Valve Co.

—Stanley F. Levy

Decatur Foundry Co., Div. J. L. Johnson & Sons, Inc., is a new company member, Central Illinois Chapter District. Shown are **J. B. Oldham,** Peoria Malleable Castings Co., **H. R. Young,** Decatur Foundry Co. and **J. L. Johnson,** J. L. Johnson & Sons, Inc.

Tri-State Chapter

Steel Casting vs. Fabrication

■ Advantages of cooperation between casting design engineers and foundry engineers were explained at the October meeting by William L. Smith, Webb Wheel Div., American Steel & Pump Corp., Siloam Springs, Ark.

Smith used castings to show where parts had been redesigned with some metal sections eliminated, with heavy sections used where strength was needed and with light sections not subjected to stress, thus making a part with less weight and more utility. One demonstration showed two wheels for tandem units. One required the use of four cores and had feeding problems resulting in a very poor yield. The redesigned wheel required only one simple core and a simplified feeding process which resulted in a better, and lower cost.

—Frank M. Scaggs

Detroit Chapter

Casting Process Developments

■ R. M. Critchfield, process development staff, General Motors Corp., at the October meeting discussed work currently being performed at General Motors in the development of aluminum alloys and engines.

R. F. Thomson
Tech. Chairman

R. M. Critchfield
Detroit Speaker

The discussion included various approaches to using aluminum in cylinder blocks and problems encountered. Slides showed equipment designed in the process development department and the general increased use of aluminum in the foundry industry. Dr. R. F. Thomson, General Motors Corp., was technical chairman. Chapter Chairman Grant Whitehead, Dace Industries, Ltd., presided.

—J. R. Young

Charles E. Drury, Central Foundry Div., General Motors Corp., Danville, Ill., (left) is congratulated by Technical Chairman **L. G. Zuercher,** Central Pattern Co., St. Louis. Drury addressed the St. Louis Chapter in October on pouring effect on scrap. **—W. E. Fecht**

Central Indiana Chapter's Picnic Draws More Than 500 Foundrymen

Rochester Chapter

Coremaking & Coreblowing Talk

■ How to get improved performance from coreblowing was explained at the October meeting by Z. Madacey, Beardsley & Piper Div., Pettibone Mulliken Corp., Chicago.

Faster coreblowing is possible by keeping moisture low and green strength and deformation to the minimum. Core boxes must be sealed against leakage; properly vented for maximum speed; and boxes, vents, screens and filters must be clean at all times. Slides illustrated how cores could be rodded and vented on the blow machine and different types of blow plates.

Madacey illustrated the speed of the process by stating that one man making four cores per hour (40 x 1 in.) could produce 28 cores per hour through core blowing. Chapter Chairman Charles D. Loomis, General Railway Signal Co., Rochester, N. Y., presided.

—Haerle Wesgate

Metropolitan Chapter

Discusses Research Projects

■ Developments and results of AFS research projects were discussed at the October meeting. Speakers and their subjects were:

Non-Ferrous, Fred L. Riddell, H. Kramer & Co. Riddell in an illustrated talk stressed the importance of establishing an optimum thermal gradient within the casting to promote proper feeding. Various artifices used to develop this thermal gradient were discussed in detail with sampling techniques used prior to pouring the casting to determine the quality of the metal.

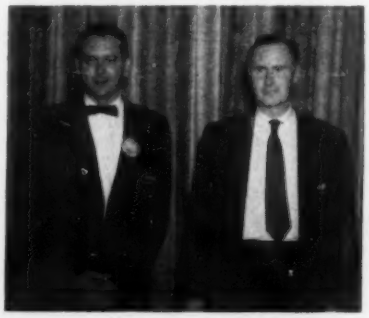
Steel, A. J. Kiesler, General Electric Co. Snotters are essentially Al_2O_3 or corundum and small amounts of silica, fayalite and other materials. Prime causes of snotters are aluminum (deoxidizer) plus 0_2 in steel and alumina found in ladle refractories. Partial solutions involve gating techniques and bottom pouring from ladles.

Gray Iron, Prof. J. F. Wallace, Case Institute of Technology. The proper pouring time is a function of the weight of the casting, its average section thickness and metal fluidity. In gating a tapered sprue should be used. With multiple ingates runners should be stepped. Ingates should be taken off the top of the runner. Risers should compensate for mold wall movement with side risers best for cast iron. The riser height should equal the riser diameter as long as the top of the riser is located 1 in. above the uppermost point of the casting.

—C. H. Fetzer

Steel speaker at October meeting of the Metropolitan Chapter was **A. J. Kiesler,** right, General Electric Co. Technical chairman was **Charles Schwalje,** Worthington Corp.

Non-ferrous speaker at the October meeting of the **Metropolitan** Chapter was **F. L. Riddell,** left, H. Kramer & Co. Technical chairman **G. T. Fischer,** Fischer Casting Co.



Gray iron foundrymen of **Metropolitan** Chapter in October heard **Prof. J. F. Wallace,** Case Institute of Technology, on right. Technical chairman was **John Steinbeck,** A. P. Smith Mfg. Co.

AFS Regional Vice-President **A. A. Hochrein,** center, attended the October meeting of the **Metropolitan** Chapter. On left is Chapter Chairman **Robert B. Fischer,** Ingersoll-Rand Co. and on right, Vice-Chairman **John P. O'Neill,** Malcom Foundry Co.

Twin City Chapter Provides Traveling Foundry for Educational Purposes

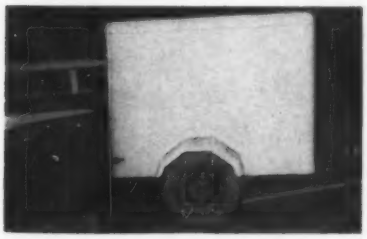
Photos courtesy of Mesabi Daily News

■ A traveling foundry, provided by the AFS Twin City Chapter, is being used for practical training purposes in Minnesota. The trailer includes a molding bench, gas-operated furnace and other equipment needed for producing castings. It was used initially this summer at the 4th annual Minnesota industrial arts workshop held at Arrowhead Lake.

In 1958 it was suggested to the chapter's education committee that a mobile foundry could be used throughout the state for practical training purposes and as an aid to industrial arts education. The chapter's board of directors voted support of the idea. A number of industrial arts teachers throughout the state went to work on the project under the direction of Fred Gordon, Assistant Supervisor of Trade and Industrial Education, Minnesota Dept. of Education.

Trailer construction was finished in June. Then local foundries and supply firms in the chapter furnished the necessary equipment and supplies.

Forty-two industrial arts teachers from various parts of the state received instruction in foundry and sheet metal fundamentals at the Minnesota industrial arts workshop.



Twin City mobile foundry.

Pouring aluminum ash trays at workshop.

Workshop projects made by instructors.

Finishing sand mold.

Former Foundry Students Honor Instructor Davis

■ Twelve Chicago Chapter foundrymen in October held in honor of George A. Davis, now a retired Tuscon, Ariz., resident. He was formerly an instructor at Chicago's Crane Technical High School. Those attending were former students of Davis.

Former Chicago foundry instructor **George A. Davis** was guest of honor given by his former students.

Former students at the dinner were Edward Maffia, Peter Laporte, Al DiGirolamo, Frank Kamberos, Frank Mastrantonio, Christ Kamberos, Dominic Savaiano, Robert LaRocca, Arthur W. Speer, August Vlahos, Ronald Bonjerno, William C. Wick, Bob Stolezman, George DiSylvestro.

G. L. Armstrong, U. S. Reduction Co., East Chicago, Ind., in September told **Wisconsin** foundrymen about metallurgy of aluminum alloys. —**Bob DeBroux**

More than 600 persons attended the Management Night of the **Wisconsin Chapter** in October. Three of the speakers were: **Lyman Conger,** Kohler Co., Kohler, Wis., **William Grede,** Grede Foundries, Inc., Milwaukee and the AFS 1960 Hoyt Lecturer, and **Herbert V. Kohler,** Kohler Co.

—**Bob DeBroux and Don Gerlinger.**

William L. McGrath, Williamson Co., Cincinnati, featured speaker at the Wisconsin Chapter's Management Night. McGrath spoke on "The Surprising Case of the I.L.O."

Quad City Chapter members in September heard **W. C. Capehart,** Monsanto Chemical Co., Inc., discuss foundry sand problems. Shown are speaker Chadwick discussing talk with Chapter Vice-Chairman **Clifford E. Erickson,** Frank Foundries, Inc., Moline, Ill.

—**William Ellison**

Union of South African visitor, **J. J. Marais,** G & W. Base & Industrial Minerals (Pty) Ltd., Johannesburg (left) is welcomed by Chicago Chapter Publicity Chairman **George DiSylvestro,** American Colloid Co., Skokie, Ill. Marais is a past president of the South African branch of the Institute of British Foundrymen.

Chicago Chapter Chairman **John Mulholland,** Pettibone & Mulliken Corp., gets 1959-60 season away with a smile. Others are 1958-59 Chapter Chairman **Don Schmidt,** H. Kramer & Co. and **Prof. Roy Schroeder,** University of Illinois, Navy Pier. **—George DiSylvestro**

Technical Chairman **Don Meves,** American Steel Foundries, congratulates speaker **William Macomb,** Inland Steel Co., who addressed **Chicago Chapter** on impact of St. Lawrence Seaway on Chicago's industrial growth.

Northeastern Ohio Chapter

Use of Exothermic Materials

■ How to avoid shrinkage and increase yield with exothermic and insulating materials was explained at the October meeting by H. F. Bishop, Exomet, Inc., Conneaut, Ohio. Two basic problems exist in risering; providing enough feed metal and getting all portions of a casting within feeding range of the risers.

Different alloys require different feeding because of varying mushy zones. Complete directional solidification is the objective. Since riser diameter is more important than volume, risers should be wide, not higher, in order to feed properly. Chills aid attainment of directional solidification and exothermic and insulating materials markedly improve yields.

Approximately 150 members and guests attended the meeting including Hans Rudberg of the Iron Refining Co., a malleable iron foundry in Halleforsnas, Sweden. *—Jack C. Miske*

Use of exothermic and insulating materials was explained at the October meeting of the **Northeastern Ohio** meeting by **Harold F. Bishop,** Exomet, Inc., Conneaut, Ohio. Technical Chairman **John F. Wallace,** Associate Professor of Metallurgical Engineering, Case Institute of Technology, Cleveland, is on right. **—Harold Wheeler**

R. W. Heine and **C. Loper, Jr.,** University of Wisconsin, spoke on heavy section malleable at September meeting of **Wisconsin Chapter.**

Tennessee Chapter members in September were given practical tips on cupola operation by **Sam F. Carter,** American Cast Iron Pipe Co., Birmingham, Ala. Shown are Chapter Vice-Chairman **Tom A. Deakins,** Combustion Engineering, Inc., speaker Carter and Chapter Chairman **Charles E. Seman,** Crane Co. **—J. L. Duggan**

Canton Chapter members in October heard **R. W. Gardner,** (center) Ford Motor Co., Dearborn, Mich., discuss "Quality Control in the Foundry." Others are AFS National Director **R. E. Mittlestead,** Lectromelt Casting Div., Akron Standard Mold Co., Barberton, Ohio, and Chapter 1st Vice-Chairman **F. A. Dun,** Babcock & Wilcox Co., Barberton, Ohio. **—Charles Stroup**

Philadelphia Chapter foundrymen and sons at October meeting: **Wesley Williams,** Janney Cylinder Co., Philadelphia and son **Gary Williams; Zen Scott** and father **William Scott,** also of Janney Cylinder Co.

Wisconsin panelists in September discussing cleaningroom problems: **Fred Klevssendorf,** Crucible Steel Casting Co.; **Ray Zobel,** Bucyrus-Erie Co.; **A. J. Hickey,** Sivyer Steel Casting Co.; **O. V. Cook,** Racine Steel Casting Co. **—Bob DeBroux**

Philadelphia Chapter conducted its William B. Coleman night in October. Shown are: **John E. Koop,** Pennsylvania State University, recipient of this year's Wm. B. Coleman scholarship award; Chapter Vice-Chairman **Robert C. Stokes,** Crown Non-Ferrous Foundry, Inc., Chester, Pa.; speaker **Dr. J. C. Elgin,** dean of engineering, Princeton University, Princeton, N. J.; Chapter Chairman **E. A. Zeeb,** Dodge Steel Co., Philadelphia; Coleman award chairman, **W. S. Giele,** W. S. Giele Co., Lebanon, Pa. —**Leo Houser, E. C. Klank**

Attending the **Tri-State** October meeting were: **Paul Lindley,** Peoria Malleable Co.; speaker **W. L. Smith,** Webb Wheel Div.; **Charles Gilchrist,** Oklahoma Steel Castings; Vice-Chairman **Harry Ferlin,** Tulsa Pattern & Mfg. Co.; **Edward O'Brien** and Chapter Chairman **William Pitts,** Oklahoma Steel Castings Co.
—**Frank M. Scaggs**

Philadelphia Chapter encourages foundries to have supervisory personnel attend monthly meetings. Supt. **Wm. Goessel,** Beloit Eastern Corp., Downington, Pa., poses with his supervisors.

Importance of water content in molding sands was explained to members of the **Southern California** Chapter in October by **W. D. Emmett,** Los Angeles Steel Castings Co. He discussed investigations into various physical properties of molding sands made of sand, fire clay and bentonite when mixed with varying percentages of water.—**K. F. Scheckler**

Tri-State speaker **W. L. Smith** demonstrated how redesigns could improve castings and fight other methods of fabrication.

Texas Chapter

Conducts Gray Iron Panel

■ A gray iron panel discussion was held at the October meeting with John Kines, Tennessee Products & Chemical Corp., as moderator. Members were: Edwin E. Pollard, Western Foundry Co., Tyler, Texas; Charles McGrail, Alamo Iron Works, San Antonio, Texas; H. L. Roberts, Oil City Iron Works, Corsicana, Texas; and Harold H. Judson, University of Houston, Houston, Texas.

A great many questions were answered by the panel including problems dealing with metallurgy, sand control and properties and mold hardness. —*Harold H. Judson*

afs chapter meetings

DECEMBER

Birmingham District . . *No Meeting.*

British Columbia . . *No Meeting.*

Canton District . . **Dec. 3** . . American Legion Hall, Massillon, Ohio . . T. W. Curry, Lynchburg Foundry Co., *"Ductile Iron Processing."*

Central Indiana . . **Dec. 7** . . Athenaeum, Indianapolis . . C. E. Wenninger, Beardsley & Piper Div., Pettibone Mulliken Corp., *"Digging into Sand Fundamentals."*

Central Ohio . . **Dec. 14** . . Seneca Hotel, Columbus, Ohio . . T. O. Kuivinen, Cooper-Bessemer Corp., *"What Does Casting Designer & Buyer Expect from Foundryman?"*

Chesapeake . . **Dec. 4** . . Engineers' Club, Baltimore, Md. . . S. J. Pohl, Jackson Iron & Steel Co., *"Use of Silvery Pig in the Cupola."*

Chicago . . **Dec. 7** . . Chicago Bar Association, Chicago . . *Iron Group*: J. S. Schumacher, Hill & Griffith Co., *"Practical Way to Meet Demand for High Accuracy Castings"; Non-Ferrous Group*: J. Hamlin, National Cylinder Gas Co., J. W. Lauder, Aurora Metal Co., *"CO_2 Versus Shell"; Steel Group*: J. W. Baldwin, American Manganese Steel Div., American Brake Shoe Co., *"Production of Austenitic Manganese Steel."*

Cincinnati District . . **Dec. 19** . . Netherland Hilton Hotel, Cincinnati . . *Christmas Party.*

Connecticut . . **Dec. 16** . . Waverly Inn, Cheshire, Conn. . . *Christmas Party Held Jointly with Connecticut Non-Ferrous Foundrymen's Society.*

Corn Belt . . **Dec. 13** . . Cotner Terrace, Lincoln, Neb. . . *Christmas Party.*

Detroit . . **Dec. 5** . . Wolverine Hotel, Detroit . . *Dinner Dance—Ladies' Night.*

Eastern Canada . . **Dec. 4** . . Mount Royal Hotel, Montreal, Que. . . G. O. Pfaff, Wheelabrator Corp., *"Reducing Blast Cleaning Costs."*

Eastern New York . . **Dec. 15** . . Panetta's, Menands, N. Y. . . *Christmas Party.*

Metropolitan . . **Dec. 11** . . Essex House, Newark, N. J. . . *Annual Christmas Party.*

Continued on page 76

chapter meetings

Continued from page 75

Michiana . . Dec. 14 . . Spaulding Hotel, Michigan City, Ind. . . W. V. Frid, Tylene Plastics, Inc., *"Why Use and How to Make Plastic Patterns."*

Mid-South . . Dec. 19 . . Claridge Hotel, Memphis, Tenn.

Mo-Kan . . Dec. 5 . . President Hotel, Kansas City, Mo. . . *Annual Ladies' Night Christmas Party.*

Northeastern Ohio . . Dec. 11 . . Carter Hotel, Cleveland . . *Christmas Stag Party.*

Northern California . . Dec. 14 . . Spenger's Cafe, Berkeley, Calif. . . *Casting Clinic.*

Northern Illinois & Southern Wisconsin . . Dec. 5 . . Faust Hotel, Rockford, Ill. . . *Christmas Party.*

Ontario . . Dec. 11 . . Seaway Hotel, Toronto, Ont. . . *Ferrous Group:* H. H. Wilder, Vanadium Corp. of America, *"Controlling Cupola Variables"; Non-Ferrous Group:* W. M. Ball, Jr., R. Lavin & Sons, *"Effective Essentials of Good Non-Ferrous Castings."*

Philadelphia . . Dec. 3 . . Sheraton Hotel, Philadelphia . . *Christmas Party.*

Piedmont . . *No Meeting.*

Pittsburgh . . Dec. 14 . . Penn-Sheraton Hotel, Pittsburgh, Pa. . . *Christmas Party.*

Quad City . . *No Meeting.*

Saginaw Valley . . Dec. 3 . . Fischer's Hotel, Frankenmuth, Mich. . . E. Hinze, E. T. Runge Associates, *"Foundry Cost Reduction."*

St. Louis District . . Dec. 10 . . Golden Fried Chicken Loaf Restaurant, St. Louis . . B. M. Appleman, Texas Foundries, Inc., *"Texas Foundries' Quality Improvement Program." Joint Meeting with American Society for Quality Control.*

Tennessee . . *No Meeting.*

Texas . . Dec. 11 . . Texas A & M College, College Station, Texas.

Texas, San Antonio Section . . Dec. 7 . . K. O. Steel Foundry, San Antonio, Texas . . C. E. Silver, Sales Engineer, *"Flask Equipment & Molding."*

Tri-State . . Dec. 12 . . Mayo Hotel, Tulsa, Okla. . . *Christmas Party.*

Twin City . . Dec. 5 . . Hotel Nicollet, Minneapolis . . *Christmas Party.*

Western Michigan . . Dec. 5 . . Muskegon Country Club, Muskegon, Mich. . . *Christmas Party* . . **Dec. 7 . .** Bill Stern's, Muskegon, Mich. . . *Cupola and Non-Ferrous Melting Panels.*

Western New York . . Dec. 4 . . Sheraton Hotel, Buffalo, N. Y. . . L. B. Knight, Lester B. Knight & Associates, *"Foundry Modernization."*

Wisconsin . . Dec. 11 . . Schroeder Hotel, Milwaukee . . *Christmas Party.*

JANUARY

Central Illinois . . Jan. 4 . . Vonachen's Junction, Peoria, Ill. . . W. C. Capehart, Monsanto Chemical Co., *"New Foundry Resins & Application Techniques for Shell Molds & Shell Cores."*

Chicago . . Jan. 4 . . Chicago Bar Association, Chicago . . S. C. Massari, AFS, *"Market Development." Past Presidents' Night.*

Metropolitan . . Jan. 4 . . Military Park Hotel, Newark, N.J. . . *Non-Ferrous Group:* G. Horner, Fischer Casting Co.; *Ferrous Group:* C. F. Menzer, Superior Bearing Bronze Co.; *"Coremaking for Ferrous & Non-Ferrous Foundry."*

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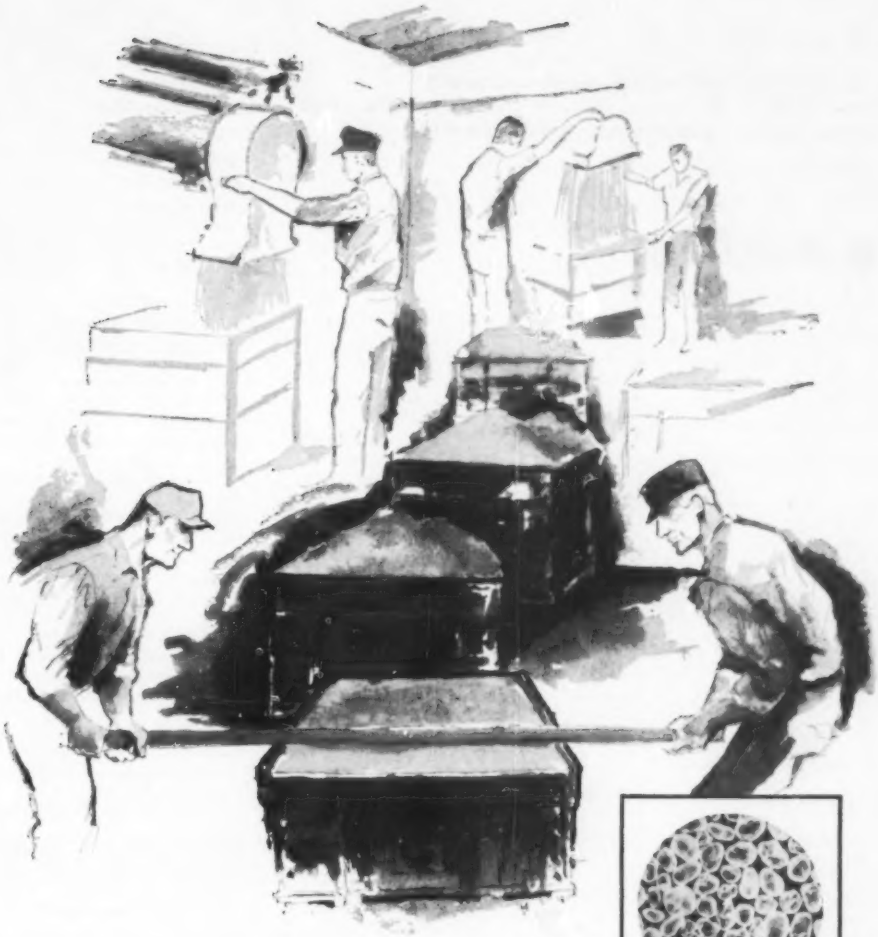

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8	20	32	44	56	68	80	92	104	116	128	140	152	164	176	188	200	212	224
9	21	33	45	57	69	81	93	105	117	129	141	153	165	177	189	201	213	225
10	22	34	46	58	70	82	94	106	118	130	142	154	166	178	190	202	214	226
11	23	35	47	59	71	83	95	107	119	131	143	155	167	179	191	203	215	227
12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228

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Continued on page 82

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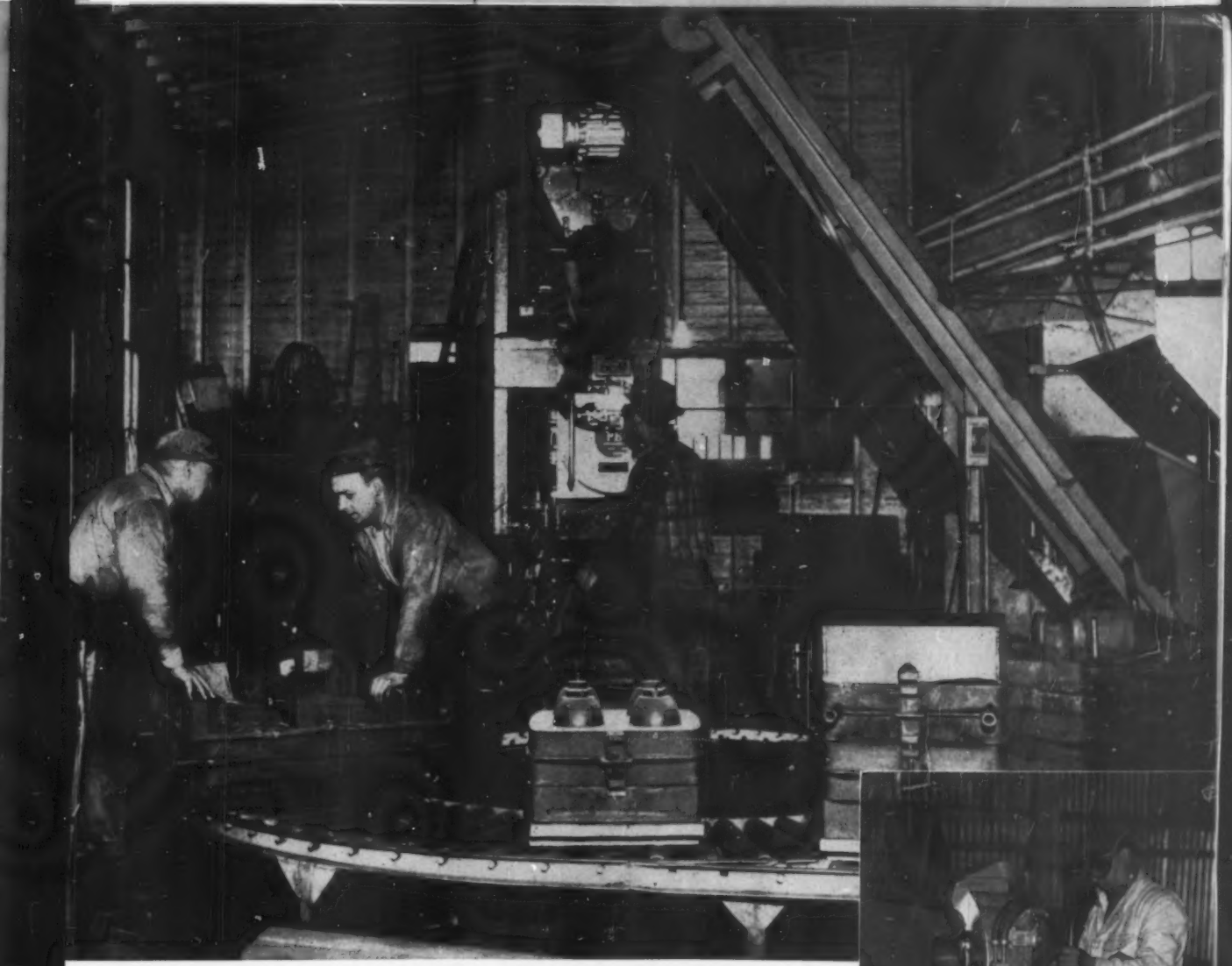

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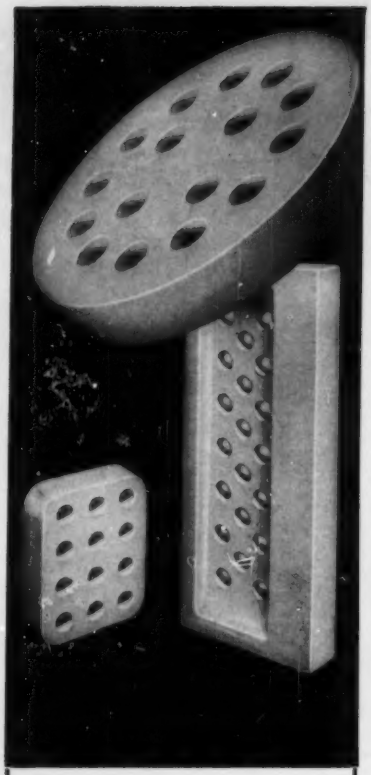

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Continued from page 80

states its equipment will help produce more molds. Send for leaflet. Nomad Equipment.
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THE BAFFLING CASE OF THE FAULTY BLOWERS

Another costly mystery solved–by the man from Kaiser Aluminum

THE PUZZLING FACTS. A good customer of Kaiser Aluminum had troubles. He manufactured a large blower casting which was to be used at high speeds. But inspection revealed that the casting had numerous cold shuts. The part was unsatisfactory. What to do?

HOW THE CASE WAS SOLVED. It looked like a tough problem, but the man from Kaiser Aluminum found an "out." He discovered that improper gating design was the villain. Redesigning the gating eliminated the difficulty and the case was solved.

WE LOVE A MYSTERY. This is one of many actual cases solved by Kaiser Aluminum working with a customer. Perhaps *you* have a mystery one of our technical engineers might help solve? He's ready to give you expert advice on any casting problem—including mold and die design, alloy selection, heat treatment, finishing, fluxing, metal transfer.

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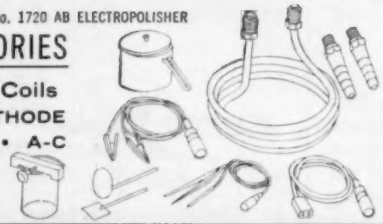

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foundry trade news

GRAY IRON FOUNDERS' SOCIETY . . . at the 31st annual meeting held at San Francisco in October re-elected as president Albert M. Nutter, E. L. LeBaron Foundry Co., Brockton, Mass. Other officers: vice-president, J. E. Quest, Shakopee Foundry Co., Shakopee, Minn.; treasurer, Cecil R. Garland, W. O. Larson Foundry Co., Grafton, Ohio; secretary, R. W. Wilder, Elkhart Foundry & Machine Co., Elkhart, Ind. New directors: Summerfield Brunk, Headford Bros. & Hitchins Foundry Co., Waterloo, Iowa; Robert E. Crowe, Crowe Foundry, Ltd., Hespeler, Canada; Cecil R. Garland; Hermann P. Good, Textile Machine Works, Foundry Div., Reading, Pa.; John C. Long, Atlas Foundry & Machine Co., Tacoma, Wash. Edward L. Roth, Motor Castings Co., West Allis, Wis., was presented with the society's gold medal.

Also honored were Cecil R. Garland, W. O. Larson Foundry Co., Grafton, Ohio, and William A. Hepburn, John T. Hepburn, Ltd., Toronto, Canada. Awards were also made for the annual design contest. First prize of $500 was given to Jack T. Eccles and Dan H. Davis, Rockford Machine Tool Co., Rockford, Ill., for a conversion of a prototype machine tool casting originally designed of welded steel. Second place and a cash prize of $100 was won by Joseph D. Walls, Roots-Connersville Blower Div., Connersville, Ind. Tied for third place with a cash award of $50 were Leroy Barnes, Oliver Corp., Shelbyville, Ill.; Michael E. Conway, Enterprise Engine & Machinery Co., San Francisco; Wes Swan and Walter Pochila, Chicago Hardware Foundry Co., North Chicago, Ill.; Jay M. Roth, Mechanisms Co., Urichsville, Ohio; and Phil McCafferty, Link-Belt Speeder Corp., Cedar Rapids, Iowa.

A. M. Nutter, left, has been re-elected as G.I.F.S. president. **E. A. Borch,** right, has been named as F.E.M.A. president.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION . . . at its 40th annual meeting held in October at the Greenbrier Hotel, White Sulphur Springs, W. Va., elected as president Einar A. Borch, executive vice-president, National Metal Abrasive Co., Cleveland. Borch, active for many years in the association, becomes the first president not directly associated with foundry equipment manufacturing. Other officers: vice-president, R. A. Brackett, Spencer Turbine Co., Hartford, Conn.; executive secretary and treasurer, C. R. Heller, re-elected. Directors: Gordon E. Seavoy, Whiting Corp., Harvey, Ill.; C. G. Hawley, Jeffery Mfg. Co., Columbus, Ohio; Roy I. Jones, Giffels & Valet, Inc., Detroit; Peter A. Burns, Hewitt-Robins, Stamford, Conn.; J. F. Connaughton, Wheelabrator Corp., Mishawaka, Ind.; Bruce L. Simpson, National Engineering Co., Chicago.

The program included product group meetings made up of blast cleaning and tumbling, dust and fume control, flask manufacturers, furnaces and accessories, material handling and processing, and molding machine. A panel discussion was held on "Depreciation of Foundry Equipment," with Richard A. Brackett as moderator. Members were Joseph E. Tansill, Lybrand, Ross Bros. & Montgomery and Charles W. Stewart, Machinery & Allied Products Institute. An interpretation of F.E.M.A. statistics was given by Eniar A. Borch. Irwin H. Such, editor, *Steel* magazine, spoke at the general session on the subject of "Russia Today."

F.E.M.A. members in replying to a questionnaire on activity for the fourth quarter of 1959 with predictions for 1960 overwhelmingly indicated that business would increase in the coming year. With 1958 representing an index of 100, 27% predicted business in 1960 would be up 175; 36% predicted 1960 business up 125-174, 30% predicted 100-124, and only seven predicted orders closed in 1960 under 100 index.

Other statistics: 46% of the members reporting stated that 75% of their foundry orders represented new facilities; 29% said they represented 50-74% new facilities; 14% said they represented 25-49% of their facilities and 11% said they represented less than 25% in new facilities.

Portion of business from foundries: 35% said over 75%; 10% said 50-74%; 20% gave 25-49%; 35% said under 25%.

Shalco Corp. . . . Palo Alto, Calif., is now a wholly-owned subsidiary of National Acme Co., Cleveland. Shalco Corp. was formed in 1953.

Hamilton Foundry, Inc. . . . Hamilton, Ohio, has won the Ohio Rehabilitation Association employer award as the Ohio company that has made the outstanding contribution toward the rehabilitation of handicapped persons during 1959.

Peter E. Rentschler, president, Hamilton Foundry, Inc., (left) receives award.

Wheelabrator Corp. . . . Mishawaka, Ind., has acquired Lake Erie Machinery Corp., Buffalo, N. Y. The company operated as a wholly-owned subsidiary, manufactures a variety of hydraulic and extrusion presses for metal processing industries and die casting machines and equipment for the printing industry.

Meehanite Metal Corp. . . . New Rochelle, N. Y. has been purchased by Harry H. Kessler & Associates of St. Louis. Kessler, president of Sorbo-Mat Process Engineers, St. Louis, Sorbo-Cast Corp., New Brunswick, N. J. and Foundry Design Co., St. Louis is also president of Meehanite. No change is planned in location or operations. Meehanite will continue to operate as a separate company.

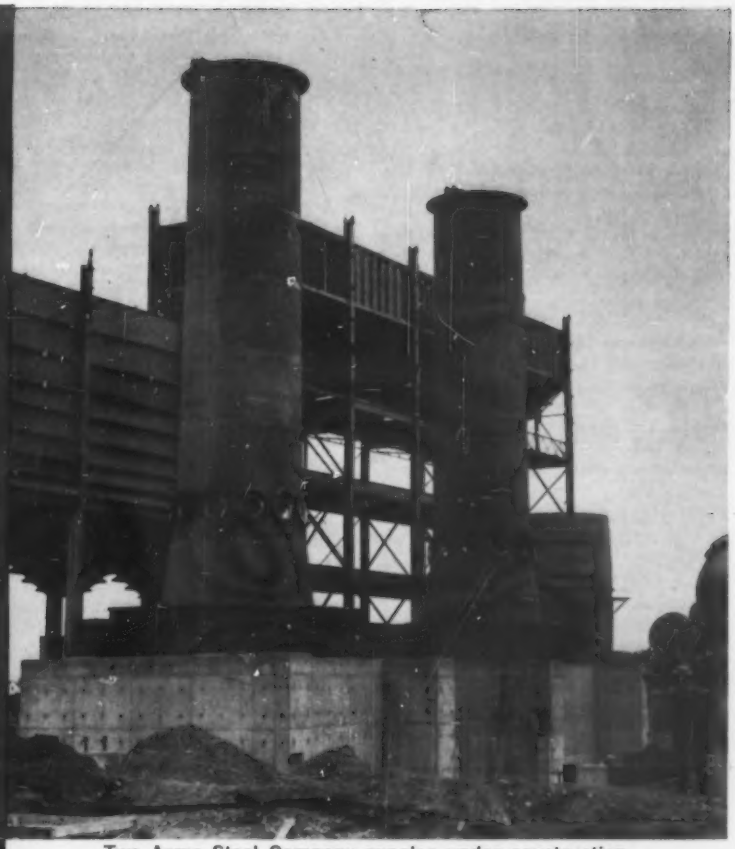
Magnaflux Corp. . . . Chicago, has been acquired as a subsidiary by General Mills, Inc., Minneapolis, and will be operated independently of any division of General Mills. R. A. Wilson, General Mills vice-president and general manager of its Mechanical Div. is the new president succeeding F. B. Doane who has retired as president and chairman of the board but will serve as a consultant.

Chance Vought Aircraft, Inc. . . . Dallas, Texas, is beginning a $1,000,000 modernization of its heat treating facilities. Vought will have equipment to heat treat steels as well as molybdenum, vanadium, tungsten, columbium, tantalum and thorium. Temperatures of 3000 F will be possible.

Bendix Aviation Corp. . . . has acquired a magnesium alloys patents license from

Continued on page 88

World's largest cupolas at Acme Steel Company use...



Two Acme Steel Company cupolas under construction.

Photo illustrates a temporary sub-assembly following machining of a section of the three-block-high "National" carbon weil zone lining.

NATIONAL
TRADE-MARK

CARBON LININGS

These two cupolas will provide hot metal for Acme Steel Company's new oxygen converter plant at Riverdale, Illinois. Both of these cupolas measure 13 feet at the base plate and each will accommodate a 40-foot column of raw materials as compared to the 25 feet of a typical cupola.

These carbon linings — because of their chemical resistance and physical stability at high temperatures — permit extended campaigns without shutdown for lining repairs. This affords saving in maintenance materials and labor while maintaining production.

Here again is an outstanding example of the trend to carbon in cupola linings. Its resistance to attack from either acid or basic slag, low co-efficient of thermal expansion, and high strength at elevated temperatures make "National" carbon an ideal material for lining cupola wells, breast areas, front slagging spouts and slag dams.

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Circle No. 180, Page 21 or 79

foundry trade news

Continued from page 86

Magnesium Elektron Ltd., Manchester, England. The license gives Bendix the right to manufacture, use or sell in the United States castings produced by Magnesium Elektron's techniques or by means of utilizing any of the inventions covered by the British patents. Included are the zirconium rare earth and thorium series and the magnesium-silver-rare earth alloy.

Allis-Chalmers Mfg. Co. . . . Milwaukee, has acquired the assets of the Valley Iron Works Co., Appletin, Wis. Valley Iron works will operate as a wholly-owned subsidiary under the name of Valley Iron Works Corp., continuing to manufacture papermaking machinery.

R. W. G. Foundry Co. . . . Anderson, Ind., a gray iron jobbing shop, has been completely destroyed by fire.

Caterpillar Tractor Co. . . . Peoria, Ill., in January, 1960 will consolidate its domestic sales, parts, service and treasury operations. Nineteen of the company's northwest and southwest divisions, currently at San Francisco will occupy offices at Peoria. Northwest and southwest division field and district representatives will continue at their present locations.

American Steel Foundries . . . Chicago, sales and net income improved substantially in the year ended Sept. 30, 1959 compared with 1958. Net income increased to $7,168,027 or $5.30 per share, up from $4,524,393 or $3.50 per share, in fiscal 1958. Sales were $112,311,287 compared with $94,543,123 a year ago. Directors have proposed a two-for-one split of the common stock, subject to stockholder approval at the annual meeting Jan. 19. Stockholders will be asked to increase the company's authorized common stock from the present three million shares to ten million.

Benj. Harris & Co. . . . Chicago Heights, Ill., has been appointed a distributor for Olin aluminum alloy, pig and ingot. The company maintains branch offices and warehouses in Detroit, Minneapolis, Tulsa, Okla. and Houston, Texas. Fischer-Fixman Metal Co., St. Louis, has been appointed a distributor of aluminum alloy, pig and ingot.

Kaiser Refractories & Chemicals Div. . . . has moved its regional office from Hammond, Ind., to Mexico, Mo., and combined with the central division sales office. The office is responsible for sales of all of the division's refractories and chemical products in the midwest.

Eastern Gas & Fuel Associates . . . Boston, has closed its Mystic blast furnace in Everett, Mass. The furnace produced pig iron principally for New England consumption. A constantly shrinking market led to shut-down.

Basic, Inc. . . . Cleveland, reports third quarter sales of $4,302,413, net income of $40,790, preferred dividends of $37,732 and net for common stock of $3,058. Corresponding results for the third quarter of 1958 were sales of $5,085,966, net income of $503,743, preferred dividends of $25,050 and net for common stock of $478,693. In view of the company's closeness with the steel industry, president H. P. Eells observes that the third quarter net is a direct result of the low rate of steel activity during this period.

Swindell-Dressler Corp. . . . Pittsburgh, Pa., has been acquired as a wholly-owned subsidiary of Pullman, Inc. Swindell-Dressler will remain at its present location in Aspinwall, Pa., and will continue to operate in the same manner with no changes in officers or personnel. Pullman, Inc. also operates the Pullman-Standard Div., and owns all the stock of M. W. Kellogg Co., Trailmobile, Inc., and Transport Leasing Co.

Western Foundry Co. . . . Tyler, Texas, has been sold to Woodward Iron Co., Woodward, Ala.

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OLIVER MACHINERY COMPANY

Grand Rapids 2, Michigan

Circle No. 181, Page 21 or 79

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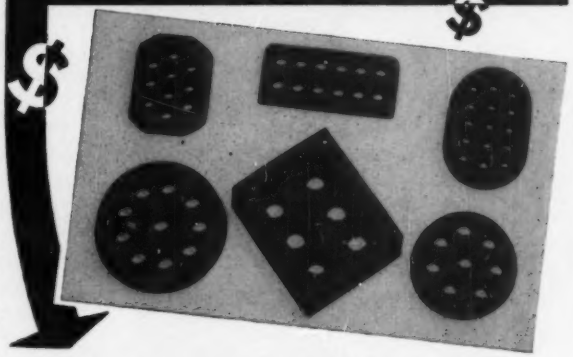

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Circle No. 182, Page 21 or 79

VOLCLAY BENTONITE

NEWSLETTER No. 65

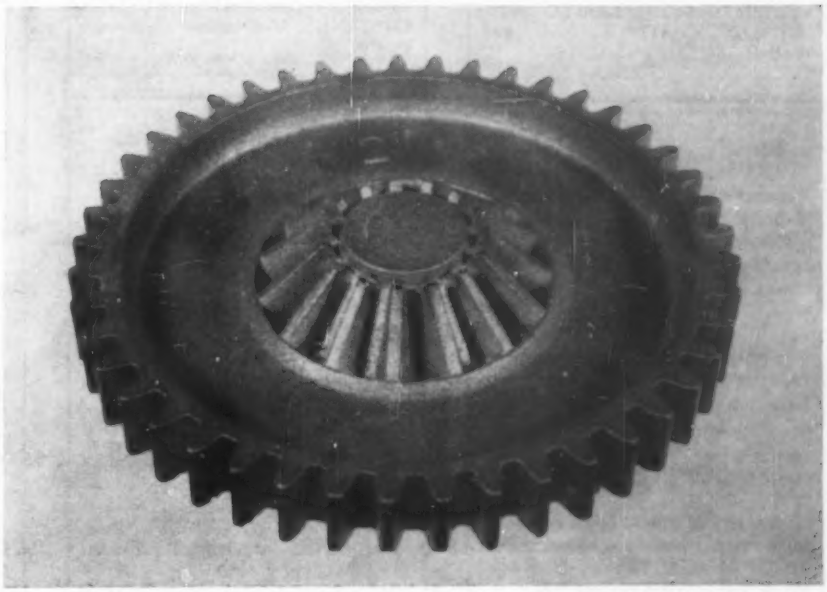
REPORTING NEWS AND DEVELOPMENTS IN THE FOUNDRY USE OF BENTONITE

AS CAST IN GREEN SAND

Castings can be held to close dimensional tolerances in green sand molding. The photo is proof.

It is a misconception that green sand castings means a loss of tolerance and precision. Close tolerance green sand castings can be produced!

Certain literature has led designers, casting architects and purchasers of castings to believe that if precision and tolerance is desired, other than green sand castings must be sought.



Since variations in casting design and the molding method have considerable influence on dimensional variations in castings, it is difficult to set universal standards. **However, green sand castings can be made as true to pattern size as with any other method.**

The closer tolerance and precision required, the more control, supervision and equipment is necessary.

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Experienced on layout of all types of foundry equipment, material handling and material flows. Send complete details on work history, education and family status. Include recent photograph. All replies confidential. **Box F-140, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

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INDUSTRIAL ENGINEER—desires an Industrial Engineering or Management position. Thorough knowledge of incentive systems, plant layouts and modern equipment. Have outstanding work record with excellent references. **Box K-110, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

METALLURGIST. B.SC. degree, age 42. Eleven years diversified experience in aluminum technology including sand, permanent mold and D. C. Casting. Strong background in development, plant problems, technical control and inspection. Seven years supervisory administrative experience. **Box K-108, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

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Detroit Rocking Indirect Arc Electric Furnace Type LFC, 125 KW, Capacity 350 lbs. cold scrap, 500 lbs of molten metal. Two shells, complete with automatic electrode control, main control panel and power transformers for 12,000 volt primary power supply. All equipment used very little and in excellent condition. Immediately available. Make offer to: **Box G-111, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

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furnaces, more than 75 of them, help Ford Motor Company maintain casting production and quality standards

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LINDBERG heat for industry

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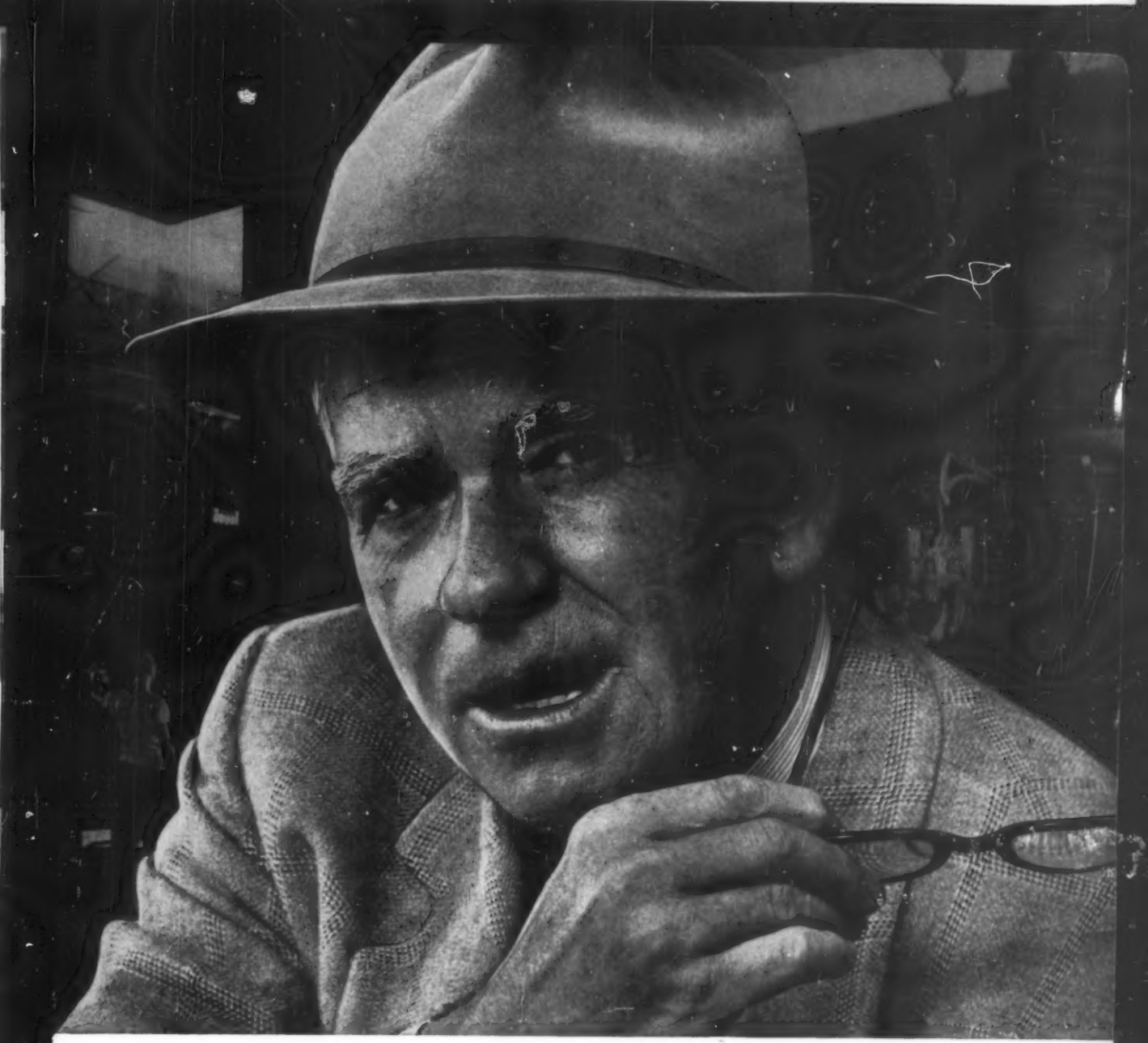
British Investigate Non-Ferrous Surface Finish

■ Many foundries producing non-ferrous castings experience considerable difficulty in obtaining an adequately smooth finish, especially on castings made in phosphor bronze and other alloys which readily penetrate into the mold material during casting.

This problem triggered an investigation by the Institute of British Foundrymen into the influence of numerous metal and mold variables on the surface finish of non-ferrous castings. The following conclusions of the investigating committee are extracted from the published report, *Surface Finish for Non-Ferrous Castings*, which appeared in the January, 1958 issue, The British Foundryman.

The surface finish of all non-ferrous castings investigated:

- Improves progressively with increasing fineness of the molding material. Relationships between the surface finish, and the permeability and AFS fineness number of the sand were established.
- Improves with the degree of ramming or compaction of the molding material, and a reasonable correlation exists between surface finish and the surface density of mold or core.
- Is influenced adversely by increasing hydrostatic head; there would appear to be a critical head height above which penetration occurs.
- May be substantially improved by the use of coatings, especially those based upon flake-like minerals.
- Depends upon the alloy composition. Generally, those alloys forming a tenacious oxide skin result in a better finish.
- Depends upon the binders employed. Binders resulting in high flowability of the sand invariably result in a better surface finish.
- Is influenced by the degree to which the sand has been used, and by certain mold additions, although the influence of these two variables is slight compared to the influence of those listed above.
- Is not influenced appreciably by the degree of venting, pattern quality within reasonable limits, many sand additions, by the drying of the sand and by pouring temperature (as long as metal penetration is absent).
- It is possible to assess the surface finish of non-ferrous castings quantitatively by touch, using a series of numbered standards for comparison.



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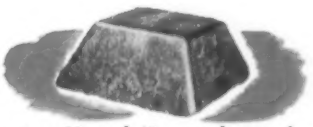

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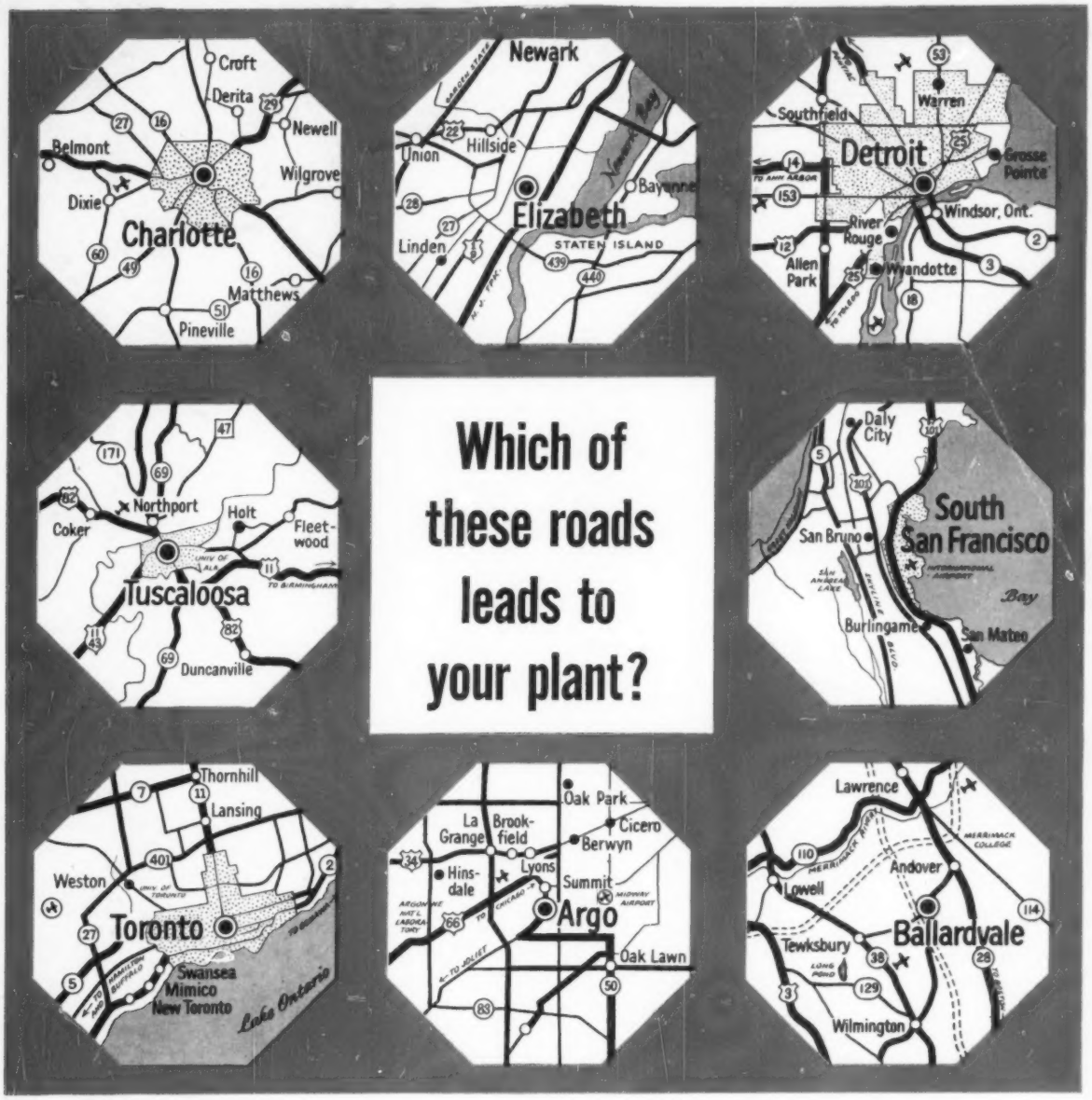

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